

August/September, 1979
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Iceberg Water

Policymaking:
Is the Public Included?

Technology Review

Edited at the Massachusetts Institute of Technology

SYNTHETIC FUELS

what we have and what
we need

SAVING ENERGY ON FOOD



technology review

Published by MIT

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Do you make these 10 common typewriter mistakes?

Most people make their fair share of typing mistakes. But the biggest mistake you can make is buying the wrong typewriter in the first place. There are ten things you should check out. They can help you avoid making these ten typewriter mistakes.

Check out the correction system. There are several typewriter correction systems, but they don't all work equally well.

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Note the look of the type. Lines and individual letters should be straight. The impression should be crisp, clean and even. The print quality should not vary over the page.



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Once you've made these ten typewriter tests, we think you'll know why more people prefer Smith-Corona electric portable typewriters than all other brands combined.

Technology Review

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Jon McIntosh

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Alumni Travel Program

1979-1980

For 1979, an expanded program of itineraries is offered, including New Guinea and a wider choice of programs in East Africa and India. Additional itineraries are also in the planning stage, including the Galapagos, southern India, the People's Republic of China and other areas.

The travel program is a special one for alumni of Harvard, Yale, Princeton, M.I.T., Cornell, Dartmouth, Univ. of Pennsylvania and certain other distinguished universities and for members of their families. Designed for educated and intelligent travelers, it is planned for persons who might normally prefer to travel independently, visiting distant lands and regions where it is advantageous to travel as a group. The programs avoid the excessive regimentation normally associated with group travel, and are planned to include generous amounts of leisure time in the course of travel to allow for individual interests.

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CENTRAL ASIA AND THE HIMALAYAS: A choice of 23 or 29-day itineraries exploring the vast historic and cultural heritage of India, the untamed Northwest Frontier region of Pakistan and the remote mountain kingdom of Nepal. Includes the famed Khyber Pass, imposing Moghul forts, sculptured temples, lavish palaces, formal gardens, the teeming banks of the Ganges, snow-capped peaks of the Himalayas along the roof of the world, picturesque cities and villages, the splendor of the Taj Mahal, and hotels which once were palaces of maharajas.

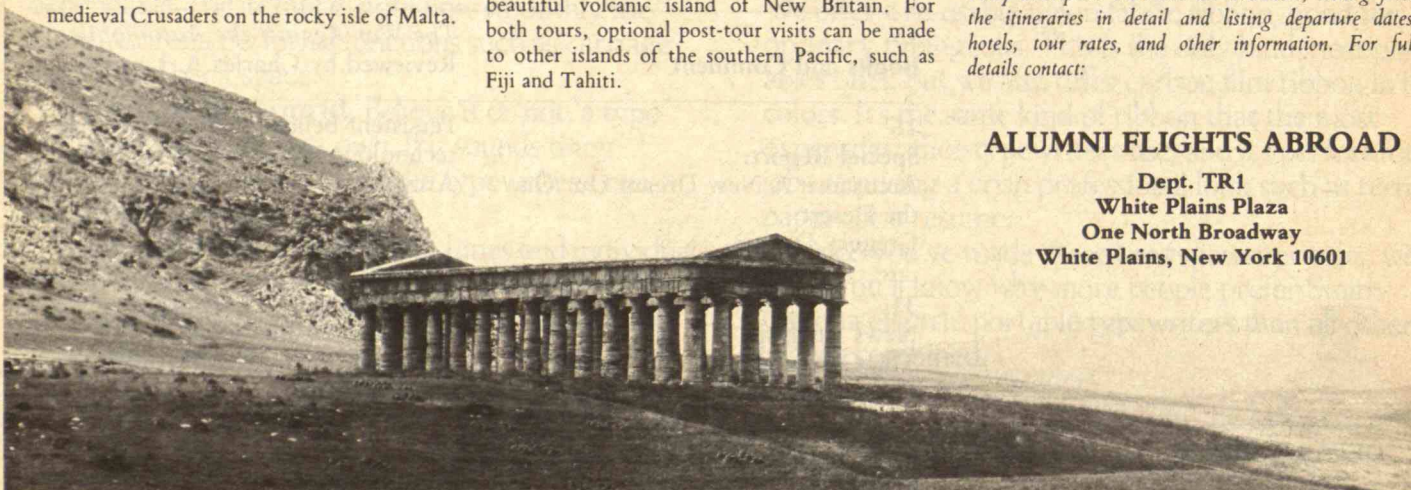
THE FAR EAST: Two itineraries which offer a fascinating insight into the lands and islands of the East. **THE ORIENT**, 29 days, is a classic tour of ancient and modern Japan, with special emphasis on the cultural treasures of Kyoto, and includes as well the important cities of Southeast Asia, from Singapore and Hong Kong to the temples and palaces of Bangkok and the island of Bali. A different and unusual perspective is offered in **BEYOND THE JAVA SEA**, 34 days, a journey through the tropics of the Far East from Manila and the island fortress of Corregidor to headhunter villages in the jungle of Borneo, the ancient civilizations of Ceylon, Batak tribal villages in Sumatra, the tropical island of Penang, and ancient temples in Java and Bali.

SOUTH AMERICA: An unusually comprehensive 28-day journey through the vast continent of South America, with dazzling pre-Columbian gold, ornate colonial churches and palaces, the ruins of the ancient Inca civilization, snow-capped peaks of the Andes, famed Iguassu Falls, the futuristic city of Brasilia, and other sights. Optional post-tour extensions are available to Manaus, in the heart of the jungle of the Amazon, and to Panama.

Prices range from \$2,215 to \$4,175 from U.S. points of departure. Air travel is on regularly scheduled flights of major airlines, utilizing reduced fares which save as much as \$600.00 and more over normal fares. Fully descriptive brochures are available, setting forth the itineraries in detail and listing departure dates, hotels, tour rates, and other information. For full details contact:

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A Substitutable Feast

An American family sits down to enjoy an appetizing and nutritious meal. There is plenty of food to go around, and the ambience at the table is one of joy, contentment and well-being. Very nice, but what is such a scene doing on the cover of *Technology Review*? And why have we substituted a fish for a turkey, in what otherwise looks like an excerpt from Norman Rockwell's famous painting, "Freedom from Want"?

One reason is that it heralds the interesting and informative article ("Energy, Food and the Consumer," by Mary Rawitscher and Jean Mayer) on page 44. The authors show that significant energy conservation is possible through sensible choices in what we eat and how we prepare our food. Moreover, such choices do not imply sacrifices or radical changes in lifestyle, and they are even desirable for health reasons alone.

But the most important reason for the cover's selection is that it says something fundamental about the *Review*'s very own beat: technology and its implications. The ultimate purpose of technology, after all, is to improve our lives and to provide the abundance, warmth, happiness and good health — characteristic of America, we like to think — which Norman Rockwell brought to such symbolic perfection. So what better way to make the point of "no deprivation, merely a substitution" than to make such a substitution on our cover? And, as a starting point, what visual idiom could ever improve upon a sincere rendition of "Freedom from Want?"

We believe our treatment not only respects the artist and his work, but responsibly extends what it stood for. We hope our readers will agree. — S.J.M.

A Dolphin Story

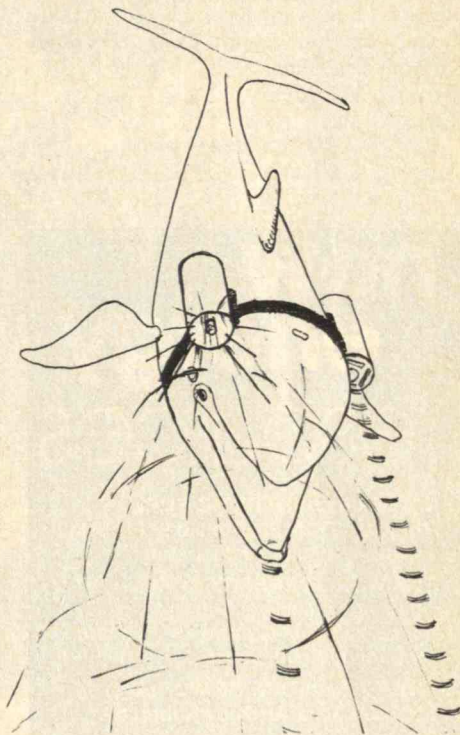
Six days before our June/July issue went to press, Robert H. Rines and Howard S. Curtis of the Academy of Applied Science announced that two trained dolphins would be used this summer in the search for the "monster" of the Loch Ness. Their earlier report, which omitted this late development in their 1979 plans, was already in type and more. But changes were quickly organized, and Charles W. Wyckoff, the expedition's photographic expert, hastened to us with his sketch of a camera/sonar-carrying dolphin; and so went into print with "Loch Ness: The Big One Got Away Again" (June/July, pages 14-16).

Alas, we (and the Academy) should

have stood in place.

As our June/July issue was being printed, the dolphins arrived in Hull, Mass., for training and to become acclimated to the colder water that awaited them in Scotland. Their progress was slower than had been hoped, and Mr. Wyckoff told Robert Cooke of the *Boston Globe* that "we really don't know when we're going over there. . . . The chances are very great we'll have to wait until next year."

Then one of the two dolphins "just stopped eating," and two days later the 14-year-old mammal died. An autopsy failed to reveal a cause of death, but the plans to use dolphins in the Loch Ness were set aside indefinitely. — J.M.



Nuclear Insurance Overdue

"Some Institutional Problems of the U.S. Nuclear Industry," by Montgomery and Rose (*March/April*, p. 53), is very good, but it does not go far enough.

The government should insure nuclear installations against technological catastrophe, just as it insures banks against financial collapse, so hapless victims can be duly compensated. Without such insurance, it could become necessary to nationalize banks. With such insurance, it should not become necessary to nationalize nuclear industry. Nuclear disaster insurance is overdue already.

The energy problem is a dilemma. It is necessary to choose the lesser evil, which is nuclear energy when compared to no energy. You can have cheese without holes, but you cannot have technology without problems.

Kenneth J. Epstein
Chicago, Ill.

Adding Solar to Hot Dry Rocks

The proposal to withdraw geothermal energy from hot dry rocks ("*Mining Earth's Heat: Hot Dry Rock Geothermal Energy*" by Ronald G. Cummings et al, *February*, pp. 58-78) is in a sense incomplete, since it does not include the use of solar energy as a natural supplement. This would be accomplished by heating fresh water in concentrating solar collectors during periods of insolation, then pumping this water into a large subterranean reservoir in a suitable formation of hot rock. The stored water would also be heated by solar energy whenever possible after withdrawal from the reservoir.

It is proposed that a storage volume of perhaps 1 million gallons of superheated water at a temperature reaching 300° C. (nearly 600° F.) be used as a thermal reservoir for an electric power generating plant. Because water may be heated under pressure to temperatures greater than 300° C. in concentrating collectors now available from solar hardware manufacturers, we propose to preheat the water before it goes into hot-rock reservoirs and then postheat the water after it comes out of the thermal storage, it should be possible to maintain an average superheated water temperature of about 300° C. forever in many terrestrial locations.

What is suggested in this concept is a further gain in thermal energy from our most useful natural heat source, the sun, using its heat efficiently concentrated so that water in the hot dry rocks (HDR) continues to gain thermal energy rather than exhausting the HDR heat source over a long period of time.

If a heat exchanger is used in the system, a variety of nonaqueous working fluids with large, low-temperature vapor densities could be used. A condenser near the ocean or other source of cold water might use this cold water to return the hot gas (after it has driven multistage turbines in parallel) to its liquid state. Then this warmed water could be pumped into solar ponds, as shown in the accompanying drawing; or used for processing and heating operations in a neighboring community.

There is no question that this proposed solar/geothermal power generating plant would have far greater efficiency than such systems as ocean platforms, where the useful temperature differential is minute compared to a system using the combination of concentrated solar heat and HDR. Also, it appears as though the economics of this proposed solar/geothermal system are far more favorable

than those of huge, expensive power towers surrounded by costly heliostats in large numbers.

E. D. Lucas, Jr.
Fountain Valley, Calif.

Puzzle Over New Zealand

I, for one, reject the so-called "reasonable explanation" of the New Zealand lights — a rejection which apparently puzzles Robert C. Cowen in his column, "Explorations of the First Kind" (*March/April*, p. 10).

Though the "experts" claim the U.F.O. to be Venus, I was amazed at the detail shown in the photograph of the U.F.O. Venus? What kind of a camera could possibly show any detail of Venus when used from Earth? So I asked an amateur astronomer whom I know and his answer made the "experts'" explanation even more difficult to accept. He said that Venus at that particular time was in quarter phase; while to the naked eye it would still look like a bright dot, with the use of a telescope it would look like a half moon in shape. Any camera capable of picking up detail of Venus should certainly show this configuration.

Until more is positively known about the source of these New Zealand lights, I must still consider them as not identified, or more simply as a U.F.O.

Erna C. Frenzel
Central Valley, N.Y.

Why Nuclear vs Coal?

I wish to compliment Mr. Montgomery and Professor Rose on an excellent review of the severe intangible constraints confronting nuclear energy and energy development in general.

The objectivity of the assessment is marred somewhat though by the nuclear versus coal debate. Coal bears a great burden of false statements as well. It is becoming starkly evident that the coal by-product sulfur dioxide is not a health issue, yet the idol makers force the nation to pay tribute to their creation.

If we need nuclear and coal, why do nuclear vested interests build the nuclear case on the "bones" of the coal contribution? We need to confront uncertainty with information and teach the inevitability of rational risk for society or the American future is grim indeed.

William E. N. Doty
Pittsburgh, Penn.

new energy resources

WATER IN SYNTHETIC FUEL PRODUCTION, by Ronald F. Probst and Harris Gold, \$9.95, paper

THE WORLD ENERGY BOOK An A-Z, Atlas and Statistical Source Book, edited by David Crabbe and Richard McBride, \$12.50, paper

THE STRUCTURE OF WORLD ENERGY DEMAND, by Robert S. Pindyck, \$20.00

ECONOMIC AND ENVIRONMENTAL IMPACTS OF A U.S. NUCLEAR MORATORIUM 1985-2010, Second edition, by members of the Institute for Energy Analysis, edited by Alvin M. Weinberg, \$17.50

ELECTRIC POWER IN THE UNITED STATES Models and Policy Analysis, by Martin L. Baughman, Paul L. Joskow, and Dilip P. Kamat, \$29.95

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CITIVIEWS is distributed quarterly to Citicorp investors. It contains viewpoints on timely public issues. We believe the following may be of interest to you...

Pushing a String

A gardener trying to make the grass grow taller in the sparse patches on his lawn by cutting it shorter somewhere else might fairly be told that he doesn't know much about grass. Yet governments, in their persistent effort to control the distribution of credit in American society, repeatedly employ precisely the same method and with equally bad results. The danger of these exercises is that while no lawn is ever improved in this way, its healthy portions may be easily and severely damaged.

All governments, ancient and modern, have at one time or another been seized by an urge to use some form of credit allocation to make credit appear at a time or place where it would not otherwise go.

The problems with political credit allocation are intrinsic to the credit process itself. Credit exists because some people are willing to pay for the use of other people's money, and those others are willing to lend their money because they like to collect rent, in the form of interest, on property for which they have no immediate use. In the market thus created, each participant vigorously pursues his or her own self-interest; lenders, savers, and investors-consumers all try to achieve the highest possible return on their money, after taking due account of the risks, while borrowers strive with equally strong desire to minimize their interest costs. Efforts to allocate credit by government fiat come into conflict with these

very human but relentless forces, and so governmental machinery for the allocation of credit never works.

This history of failure has not deterred the Government of the United States from trying repeatedly over the past fifty years to control the flow of credit by specific efforts to favor some borrowers and lenders while penalizing others. By recent count, these sporadic efforts have left us with some 150 laws and major regulations telling us what we may and may not do with our money. The restrictions most frequently encountered by the average citizen are those that limit the interest he can collect on his savings account, and that forbid him to be paid anything at all for the money he keeps in his checking account. Most regulations produce their effects more subtly and less directly, but the effects are pervasive and no one escapes their operation.

History is not lacking in examples from the past. Ever since mercantilism replaced feudalism the temptation to regulate labor, land and money has been irresistible. On May 6, 1795, the justices of Berkshire, England, met at Speenhamland. They set forth a scale of wage subsidies tied to the price of bread, so that a minimum income would be assured to workingmen irrespective of their wages. It was a time of great social distress in England, and the Speenhamland scales were intended as emergency measures. In

short order, the subsidies spread through most of the country.

"No measure was ever more universally popular," according to the late Dr. Karl Polanyi. "Parents were free of the care of their children, and children no more dependent upon parents; employers would reduce wages at will and laborers were safe from hunger whether they were busy or slack; humanitarians applauded the measure as an act of mercy even though not of justice and the selfish gladly consoled themselves with the thought that though it was merciful at least it was not liberal."

In the long run the result was disastrous. Wage subsidies, paid from public funds, removed the floor from wage levels, which sank steadily until poor relief was preferable to working. The Speenhamland law was repealed in 1834.

There are many parallels in today's society to Speenhamland's attempt to push a string, well intentioned and potentially disastrous to all concerned.

Most citizens are unaware of the provisions of the Credit Control Act of 1969. This singular piece of legislation empowers the federal government to determine which citizens of the United States may borrow money, from whom, and how they are allowed to spend it. Not generally, but specifically and in detail. It arms the President with sweeping authority to license all lenders,

register all loans, prohibit credit for purposes deemed inappropriate, prescribe maximum amounts of loans, establish maximum rates of interest, minimum down payments on purchases, and conditions for the repayment of loans. The government has never yet invoked these standby powers. But they are there, and others are now proposed.

The credit allocator's quandary is that, in the final analysis, he cannot hope to control anything unless he controls everything. If mortgage credit is cheap enough, the home owner can enlarge his mortgage and spend the money for anything he chooses, including the purchase of scarce commodities. Or a person can borrow on his or her life insurance at low interest rates set by law, thereby reducing the pool of funds that the insurance company has to invest in bonds and mortgages. To the committed allocationist the final solution is obvious: he must not only control the way our citizens lend or borrow money, but he must also control the way they spend it. And so on and on to price controls and the disasters of Speenhamland all over again.

There may be policy makers who believe this to be in the national interest, but it is doubtful that many citizens will find it to be in theirs.

* * *

A fuller discussion of this topic can be found in Credit Allocation: An Exercise in the Futility of Controls. Copies of this Citibank study are available from Citicorp, Public Affairs Department, 399 Park Avenue, New York, N.Y. 10043.

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In Extremis



Kenneth E. Boulding is Director of the Institute of Behavioral Science and Professor of Economics at the University of Colorado at Boulder. He is a regular contributor to Technology Review.

The accident at the nuclear power plant at Three Mile Island brought home very clearly how ignorant we become when systems move into an unfamiliar range. In a very large part of the experience of our daily life we move, behave, communicate, react, and decide in systems that are familiar. We wake up in the morning in a familiar bed, we stagger down to breakfast in a familiar house, take a familiar route, drive familiar vehicles. A great deal of our work is routine, "the daily round, the common task," as the hymn says; and, at the end of the day, we drop again into our familiar bed. Throughout the day, though, we are dealing with systems of immense complexity. Somehow we manage ten billion neurons inside our head. We interact with other people of similar complexity. We may operate complex machines, be making complex plans, complex decisions. As long as these remain in the familiar range, their complexity does not bother us. The more complex the system, however, the more likely it is to have a large penumbra of possible positions of low probability beyond the central set of highly probable positions which constitute the familiar. Away from this center, positions become less probable. But no matter how low the probability of anything, if we wait long enough, it will eventually happen.

Provisions for Survival

All our familiar systems sometime or other move into an unfamiliar range. We may have a heart attack, the firm for which we work may go bankrupt, someone near to us may die, war may be declared, a tornado may hit us, or a nuclear power plant may develop a gas bubble. Inevitably, this takes us into regions of ignorance. Survival, however, depends on the ability to deal with movements of the system into extreme and unfamiliar positions. Obviously, we know how to survive in the familiar or it would not be familiar. As we move further and further into the unfamiliar, a deepening cloud of ignorance enfolds us and we know less



and less about what will be the results of our actions. It becomes easier to do the wrong thing, to take the fatal step at the point of no return, beyond which lies system destruction.

Survival of an individual, a species, an organization, or a society depends in the long run on its ability to deal with the unfamiliar, the capacity to know where we are in places we have never been, and to assess situations in which we have had no experience. In the biological world, this seems to be taken care of partly by redundancy. Think of the outrageous redundancy of seed and sperm, also of behavior, and the evolution of things as absurd as sleep and play, which must have something to do with the capacity of a species to survive extreme positions of its environment. The only alternative to redundancy seems to be awareness. Species that build nests and have holes and dens, that have mother love and sharp senses, can afford to be less redundant, have fewer offspring, have narrower ranges of behavior. The balance between redundancy and awareness is a delicate one. In different species we find strategies toward one or the other end of the scale — from the vast

redundancy and tolerance of the dandelion or the herring to the precise adaptation of some wasps or the robin.

The human race is the beneficiary of both worlds. There is fantastic redundancy in the human brain. It is one of the great mysteries of evolution how natural selection could possibly have produced so redundant an organ. Because of this redundant brain, we also have the potential for a transmittable learning process, resulting in an increasing awareness, as time goes on, of the systems in which we live and move. Awareness leads to projections of alternative futures and to decision among them. We can see this even in the dog chasing the rabbit. We experience it ourselves when we jam on the brakes of a car and avoid an accident, or when our society comes to the brink of a catastrophe (as we did in the Cuban missile crisis) and draws back.

At Odds With the Improbable

Science has enormously increased our awareness of the systems in which we live. This has enabled the human race to penetrate into extreme systems where previ-

Ted Sliars



National Highway Traffic Safety Administration

The National Highway Traffic Safety Administration (NHTSA) is seeking highly qualified candidates for the position of Chief, Technology Assessment Division, GS-0801-16, annual salary \$44,756, located in Washington, D.C. (This position will be in the Senior Executive Service after July 13, 1979.)

The successful candidate will be the Chief of the Division which is assigned the function of providing technical assessment for the planning and development of rulemaking and other actions necessary for the implementation of the Administration's programs. Incumbent is responsible for formulation and conduct of research, development, test and evaluation programs in areas of automotive and industrial engineering, the technology of the automotive industry and its suppliers, and related areas of the industry's activities.

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ously it could not have survived. Without science we would not have been to the North and South Poles or to the moon. Science itself, however, has a familiar character. It is itself a subculture, engaged in expanding the epistemological field of the human race through increasing the accuracy of our images of the universe around and within us. But, like all systems, it operates best only within the familiar. The successes of science lie within a certain epistemological range of the things that there are to know. It is most successful, oddly enough, in dealing with familiar events, with the motions of the heavenly bodies and celestial mechanics, the chemical elements and their combinations, the physical patterns that are universal enough to be common, the anatomy, physiology, and ordinary behavior of living things, including ourselves. It likes things that can be done in a laboratory, which, in a sense, is a mere extension of a kitchen. It deals with things that can be written into cookbooks. It is most at home in the systems where parameters do not change, where relationships are stable, in the happy domesticity of physics and chemistry and natural history. What is natural, after all, is what is familiar. The unnatural is in the extreme positions of the system.

We cannot deny, however, that systems have extreme positions and that sometimes they move into them. Strange things happen in the extreme positions of thermodynamic systems. It is hard to believe that the evolution of the human race is not a fantastically improbable event. Highly improbable mutations must have occasionally played an enormous role in the evolutionary process. The theory of autopoiesis suggests that events of low probability may introduce irreversibilities into a dynamic system. A world of order builds itself precariously out of chaos. If the universe tells us anything, it is that chaos is unstable, perhaps even more unstable than order. In human history and experience, we get improbable stories and anecdotes. Evolutionary potentials are created, we know not how. A carpenter of Nazareth persuades his followers that He has risen from the dead and sets in motion a huge structuring of human organization, experience, art, architecture, and literature that spreads in a great wave over the whole earth for 2,000 years. A camel driver in Arabia comes up 600 years later and does the same thing. A strange young man in upstate New York in the 19th century with the commonplace name of Joseph Smith and an unremarkable face creates a church all over the world and

almost a new Rome in Salt Lake City. The history both of life and of humankind is replete with improbability.

In the face of these extreme positions, laboratory and statistical science seems very much like a homebody happily pottering around in the realm of the familiar. The problem is of particular importance for the social scientists, who rarely venture beyond the commonplace. Alfred Marshall, indeed, defined economics as "a study of the mankind in the ordinary business of life." The use of statistics in all of the social sciences glorifies the averages and aggregates of the familiar. Correlation is the study of the ordinary; it throws away the extreme cases. But in social systems, also, the ordinary stands at the center of a penumbra of extreme positions of the extraordinary and the rare event.

The trouble with extreme positions is they cannot be brought into the laboratory; they are not replicable, they do not conform to the respectable, conventional methods of science. But it is impossible to deny that they may exist. Oddly enough, it may be that we have to look toward the humanities for the study of the extremes. History as written by historians tends to be anecdotal, peculiar events of conquering kings and successful prophets. Art and literature are deposits of unfamiliar experience. Religion can be interpreted over its long history as an attempt to take the frighteningly unfamiliar events of ecstasy and agony and tame them to a familiar round of ritual and observations. One of my interests lately has been how to bring the sciences and the humanities closer together. Perhaps this is asking too much. Science is a solid, middle-class family devoted to making even the exotic familiar. Art and poetry are "far out." Perhaps this is also the business of humane letters: to extend the familiar even to these extreme positions. In scholarship we are all seated comfortably around the hearth. □

S.E.T.I.: Galactic Search for Self-Awareness



Robert C. Cowen, Science Editor of the Christian Science Monitor, is former President of the National Association of Science Writers and is a regular contributor to the Review. He holds S.B. and S.M. degrees in meteorology from M.I.T.

Ask someone about the prospects for intelligent life on other worlds and the question is apt to be a kind of Rorschach test. Even for the exobiologists, the answer will likely reflect their view of earthly life and man's role in the universe. Was the rise of life on Earth a happy accident, unlikely to be repeated elsewhere; or did it flow naturally from the expectable evolution of physical-chemical systems in favorable but, cosmically speaking, not uncommon circumstances? And what of the swift rise of intelligence and technological civilization during the past few million years — a development that still lacks adequate explanation? Was this accidental, or did it too follow a natural evolutionary pathway likely to be open to other beings on other worlds? Is humanity unique, or are we typical of what any reasonably habitable planet can be expected to evolve?

Cosmic Significance

These are the kinds of questions that proponents of S.E.T.I. — the Search for Extraterrestrial Intelligence — now are asking. They no longer are content merely to listen for alien radio signals and to speculate about their chances for success. They realize that, as A.G.W. Cameron of the Harvard-Smithsonian Center for Astrophysics puts it: "In asking about life in the universe, ostensibly we ask about life out there, but really we are asking very intensively about ourselves." In giving their search a broader and deeper perspective, S.E.T.I. advocates are identifying their quest with on-going lines of scientific research in astronomy, biochemistry, paleontology, and planetary science where the prospects for scientific payoff are more secure than in the speculative search for the electromagnetic equivalent of a note in a bottle. They hope this will help smooth the way with a skeptical Congress when

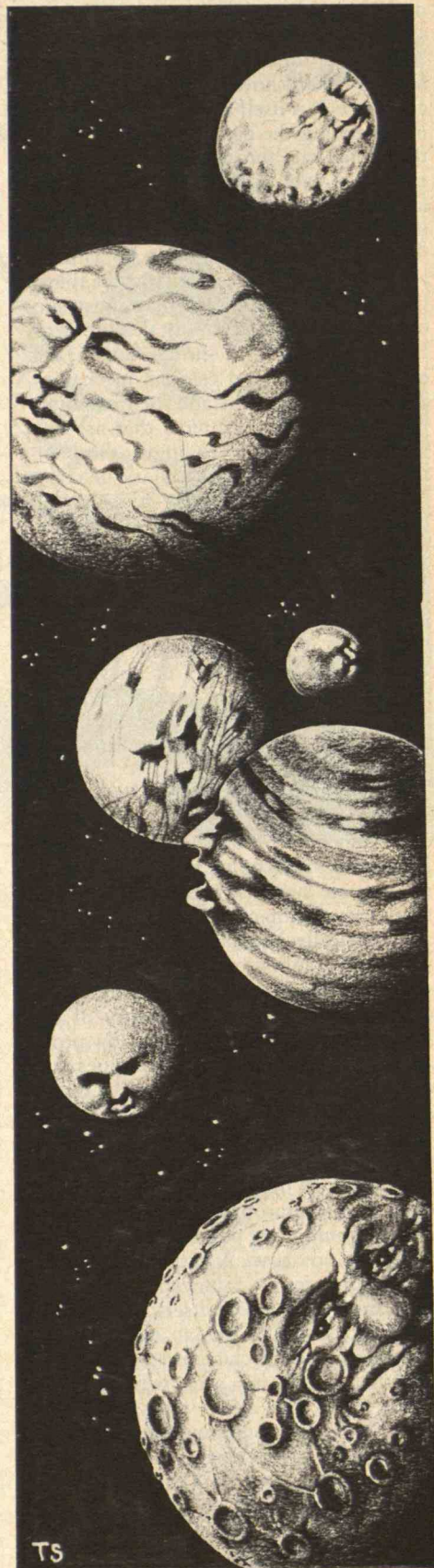
the National Aeronautics and Space Administration (N.A.S.A.) presents a new request for S.E.T.I. funds in the 1982 budget.

The general idea is that, by first understanding more clearly how life and intelligence developed on our own planet, one can better estimate the chances of there being intelligent life elsewhere and how to go about finding it. At the same time, one contributes important new understanding toward answering the ancient question of human significance in the cosmos. To help launch this new, expanded version of S.E.T.I., N.A.S.A. hosted a Conference on Life in the Universe for some 200 scientists in a number of disciplines at the Ames Research Center at Moffett Field, Calif. in June. They came, observed M.I.T.'s Philip Morrison, to discuss what has become the great "creation myth" of our time — the cosmic evolution that, out of the "big bang" explosion of primordial material some 15 billion years ago, has produced a universe of stars and galaxies and at least one intelligent species to appreciate it. Like other creation myths of other eras and cultures, this one challenges people to broaden their thought horizons and to see themselves in grander terms than the work-a-day world might inspire. But unlike these other myths, our's is susceptible to tests by the methods of experimental and observational science — tests that the myth may often fail, for it is characterized by gaps, imaginative leaps toward plausibility, and speculative groping.

To Find Other Planetary Systems

An important test that may soon be possible is the positive detection of other planetary systems. Cosmogonists think they can explain the formation of such systems by theories based on the condensation of clouds of dust and gas. But, as David Black of Ames pointed out, until another such system beyond our own is actually found and studied, it will be hard really to know what happens, let alone estimate the likelihood of planets being common in the Galaxy. Happily, according to Dr. Black and Simon P. Worden of the Air Force Geophysics Laboratory, detection of planetary systems, if they exist, should soon be possible for relatively nearby stars.

One clue would be the wobble in a star's motion induced by its planetary companions as the star moves across the sky. With improved techniques, astronomers in a year's observing should be able to pick out planetary influences with a precision of 2×10^{-5} arc second for



Ted Sillars

binaries with a separation of one arc second between component stars. For five-second binaries, the precision would be about 10^{-4} arc second.

Such accuracies are good enough to detect planets in orbits like that of Jupiter out to distances a little over 20 parsecs (about 65 light years). Dr. Worden pointed out that there are something like 188 observable star systems within that space, in most of which it is possible to have stable planetary orbits. Astronomers had doubted whether multiple star systems actually could hold on to planets or whether these would be ejected because of the gravitational perturbations of competing stars. However, Robert S. Harrington of the U.S. Naval Observatory laid that old concern to rest by showing how binaries could hold their planets.

Other ways of detecting planets, Dr. Black said, include infrared observations and the Doppler shift of a star's light produced by the sinusoidal variation of its line-of-sight velocity as planets swing around it. These are delicate observations. For the Sun viewed along the ecliptic plane, Jupiter's motion produces a velocity variation of only 12 meters a second, which translates to a spectral line shift of a few hundred billionths of a meter. This has been hopelessly beyond the reach of astronomers whose precision of measurement has only been several hundred meters per second of radial velocity up to now. That precision is improving rapidly, Dr. Black said, so that accuracies to within one meter a second should be possible within a year or two.

Likewise, he said, new methods of observing at infrared wavelengths soon promise to be able to separate the signal of a planet from that of its parent star. This will be a major observational breakthrough when you realize that, were the Sun and Jupiter to be seen from 10 parsecs (about 33 light years) distance, only about one in every 600 million photons would come from the planet. Within the next 10 to 15 years, Dr. Black said, we could have an answer as to whether or not nearby stars have planetary systems — a prospect Dr. Morrison called the "most exciting" brought out at the conference.

Inevitable Ordering of Complexity

But there are other, bigger gaps in the cosmic evolutionary story. As Eric Chaisson of Harvard University explained, no one knows what caused the "big bang" or where the universe eventually is going. And between the mysteries of the universe's origin and its ultimate fate, there is

the major puzzle of how galaxies have arisen. The present era is one of star formation within galaxies, and perhaps of the rise of life on planetary systems around stars. Galaxies do not seem to be forming now. Furthermore, astrophysicists can construct plausible theories for the formations of stars and planets. But no one can explain how the expanding gas of the early universe formed concentrations that became galaxies. What is intriguing, Dr. Chaisson said, is that it now is evident that the flow of energy through material systems encourages the development of complexity from simplicity and order from chaos. The rise of order from the simplicity and chaos of the early universe and the rise of life from simple chemical systems on Earth no longer seem accidental, and more like the inevitable results of the operation of natural laws.

With the rise of life, as with the rise of galaxies, there is a major gap — between the simple prebiotic chemicals and primitive living systems that could be called protocells. Chemists can build plausible schemes for building up prebiotic organic chemicals from the materials believed to be present on the primitive Earth and can demonstrate some of these processes in the laboratory. But how to get from there to a living system which can translate, transmit, and act upon information as now is done in the biological genetic system is what M.I.T.'s Alexander Rich called "the big intellectual stumbling block in the synthesis of life."

Yet in spite of such gaps in knowledge, Dr. Morrison noted, much has been learned to encourage one to believe that life is widespread. The occurrence of prebiotic chemicals in the interstellar dust hints at the "inevitability" of such chemicals arising wherever conditions permit. And it suggests that such conditions are more widespread than could be imagined two decades ago. Also, there seems to be an almost explosive exuberance toward organic evolution when it is given an opportunity.

Commenting on this, paleontologist James W. Valentine of the University of California observed that, when higher life forms began to emerge some 600 to 700 million years ago, they did so dramatically. "Some 25 phyla — major groups of animals — now with us (and many others no longer on Earth) all came along lickety split in just a few tens of millions of years," he said; adding that "if conditions are right, evolution can do fantastic things in very short times. . . . The fossil record on Earth should lead to optimism about the possibility of life elsewhere."

Likewise, the rise of intelligence and of technological civilization came quickly — posing another key cosmic question, as anthropologist Bernard Cambell of the L.S.B. Leakey Foundation in Pasadena, Calif., pointed out. "How could a being who was a hunter-gatherer a few million years ago suddenly find itself capable of going to the moon," he asked. The answer, when found, will be crucial to estimating the likelihood of intelligent beings existing on other worlds. For his part Eric Chaisson sees the rise of technological civilization as a main event in cosmic evolution, comparable in importance to the emergence of an ordered universe out of primordial chaos. The rise of intelligence opens a new era, he said, where, in at least some places such as planetary surfaces, cosmic evolution develops beings who reflect on matter, seek new information about it, and begin to control it to some degree.

Funds for the Larger Perspective

Such then is the background against which S.E.T.I. scientists hope to present their request for a modest effort to continue listening for alien radio signals. As part of an overall quest to understand man's place in the universe, they will ask for a few million dollars (in the 1982 budget) to use existing radio telescopes part time with improved data handling techniques and equipment to monitor large numbers of stars at many radio frequencies. Ames and the Jet Propulsion Laboratory, run for N.A.S.A. by the California Institute of Technology, are planning this effort now.

A couple of years ago, Congress cut out two million dollars for S.E.T.I. as a needless expense. Whether or not a future Congress will see the program in larger perspective and fund it is uncertain. But N.A.S.A. administrator Robert Frosch has no hesitancy in calling this search for self-awareness "central to the mission of N.A.S.A." He observed that the United States seems caught in two misconceptions. One requires scientists to try to come up with "practical" reasons for studying the unknown. The other holds that exploratory research should get low priority until the humanity's practical problems on Earth are solved. "Why," he asked, "save the human race if we don't understand where we came from and how we are related to the universe?" At the very least, when S.E.T.I.'s boosters go before Congress, they will be challenging the keepers of the purse strings to think big. □

'How Soon Can America Run on Solar Energy?'

Because Union Carbide's business depends on energy, our future growth depends on national policies which bring about reliable, long-term energy supplies from many sources, including solar. Since public attitudes help shape public policies, we commissioned a survey which included this question:

"Would you say that solar energy would actually supply major amounts of energy within the next five years for the following items? Within the next ten years?"

| | Five Years Yes | Ten Years Yes |
|--|-------------------|------------------|
| Heating and cooling private homes, apartment houses, office buildings and the like | 57% | 79% |
| Meeting the energy needs of factories | 42% | 67% |
| Providing power for cars. . | 24% | 45% |

Source: May 1979 national probability sample, by telephone, of 1,000 adults. Conducted for Union Carbide by Roger Seasonwein Associates, Inc. ("Don't knows" not shown.)

Most Americans think we will be relying heavily on solar by the 1980's.

With the price of conventional energy sources increasing and their supply uncertain, most people want America to rely more heavily on solar energy. Solar has a bright place in the nation's energy future because it offers a relatively clean, safe alternative to dwindling supplies of oil and natural gas. But how realistic are the public's expectations of how *soon* solar will be a major factor in the nation's energy picture?

Solar energy may still be 20 years away.

The goal of President Carter's recently proposed solar program is for 20 percent of the nation's energy to come from solar sources *by the year 2000*. Other analyses also place solar's contribution in this range—also by the year 2000. And while 79 percent of those questioned in our survey expect

solar to supply major amounts of energy for heating and cooling within ten years, only 21 percent of the homeowners in the poll consider themselves highly likely to replace their present systems with solar units within this period.

Why does solar seem so imminent in the abstract and so distant in practical reality? At least part of the reason for its distance is cost. A photovoltaic system capable of supplying the electricity needs of a typical home directly from sunlight currently costs about \$80,000, according to some sources—more than 20 percent higher than the median sales price of houses themselves in the spring of this year. And solar collection panels and other devices for space and water heating often offer only modest fuel cost savings relative to their installation costs.

Solar's real contribution may not come until new solar technologies bring its costs down and market pressures bring the cost of conventional energy sources up. Clearly we have a long way to go before the curves cross.

How do we get there from here?

A 1978 study by the Congressional Office of Technology Assessment found that the best way to stimulate the development of solar technologies would be to remove price controls and other subsidies on conventional energy sources. Union Carbide agrees that such policies would provide a big boost for alternative energy technologies for the future—and provide the incentives for conservation and development of domestic oil and gas needed for the present.

Union Carbide believes that solar will play an important role in America's energy future, even if that contribution is further into the future than most of us would like to think. A silicon material we've developed under a contract with the Department of Energy, for example, will eventually help lower the cost of photovoltaic cells.

But as a company involved in this aspect of solar development, we realize that the economics and technologies that make solar energy practical are still some years away. Union Carbide believes that the President's decontrol of domestic crude oil prices and proposals to accelerate the development of solar technologies are major steps in speeding the growth of solar's contribution to the nation's energy needs.

This advertisement is part of a continuing series on public opinion and national concerns.

For more information, write for a complimentary copy of the national survey, "Public Attitudes on Energy." Address: Energy, Union Carbide Corporation, Box G-18, 270 Park Avenue, New York, New York 10017.



The Preservation of the Automobile

The War Against the Automobile

B. Bruce-Briggs

New York, N.Y.: E. P. Dutton, 1977, 244 pp.; \$10.95

Reviewed by Charles A. Lave

The War Against the Automobile is guaranteed to make people very angry, initially, at least, because it stretches (some say distorts) our concept of what the automobile has done for modern society. Bruce-Briggs loves automobiles; and in our current intellectual climate, this is akin to admitting a penchant for child molesting.

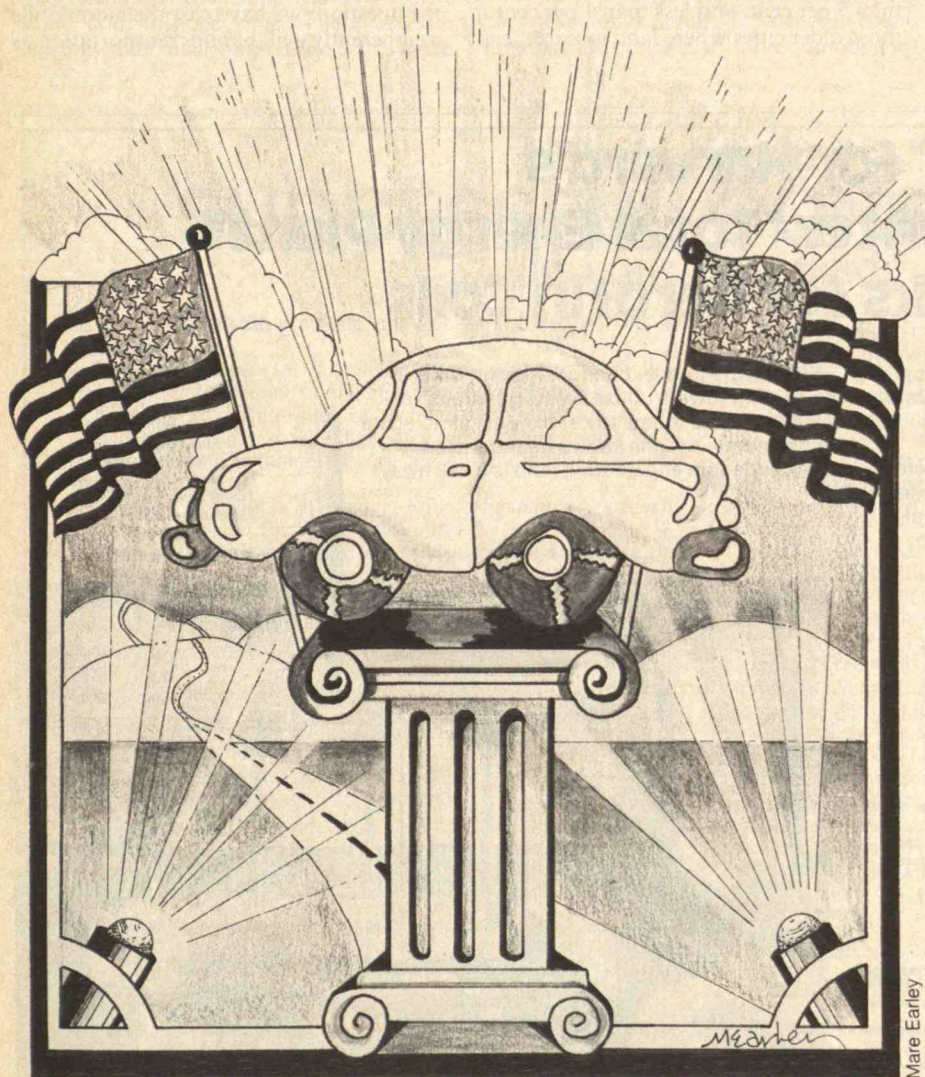
The book has two major themes: the

virtues of personal spatial-mobility and the nonsensical arguments which are generally used against the automobile. It is a kind of benefit/cost analysis; and that is also a useful framework for discussing the book. Let's look at the alleged benefits first.

The Road to Freedom

Historically, liberty of movement was a privilege limited to the very rich. Few people owned horses or had access to water transport — 90 per cent of the population was immobile and unfree. The automobile has given us a genuine revolution in transportation. For the first time in human history, mobility is broadly available, permitting "the masses" a quality of life previously inconceivable. The auto has given everyone free choice to live and work where they wished; and many have

(Continued on p. 14)



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(Continued from p. 13)
 chosen to move out to the edges of the city — a privilege formerly accorded only to the upper classes.

Of course, there are urban planners who condemn suburban living and who wish to impose central-city life on everyone, apparently in the belief that, being experts, they know what is best for us. Bruce-Briggs challenges this new elitism: "I would argue that suburban development is not a cost to be charged to the automobile, but a benefit to be assigned to it. The car has made a better quality of life possible for most Americans."

Car's Bad Name

Next Bruce-Briggs turns to an analysis of the alleged costs of the automobile — the reasons why we ought to abhor it. I summarize his arguments about six of these costs:

□ *The auto has "ruined" our transit systems.* Bruce-Briggs admits that cars have lured people out of transit, but this is just the expected result of a competition where the automobile is clearly superior from the users' point of view. "One might just as reasonably say that the refrigerator ruined the icebox, or that shoes ruined bare feet."

□ *The emissions problem.* He makes three points here: medical evidence suggests that it is stationary-source air pollu-

tion (industry and utilities) which causes health effects, not auto emissions; auto emission controls have already succeeded in making the air cleaner; and finally, if we really do care about pollution, then let's keep the car but put a non-polluting engine into it, e.g. use electricity or alcohol.

□ *Energy considerations.* Bruce-Briggs points out that it is easy to make cars which are more energy efficient than public transit. (My own research indicated that modern rail systems do no better than a 25-m.p.g. car!) Therefore the problem is not one of too much energy being used, but rather that the wrong kind of energy, petroleum, is being used. But this is an easy problem to solve: cars can run on electricity or flywheel power; and with only minor modifications, existing engines can burn alcohol from biomass conversion as is done in Brazil.

□ *Safety.* He argues that the car has become enormously safer over time: currently, one's chance of being killed on an average trip is about 1 in 10 million; a much lower order of risk than we routinely accept in all kinds of other human activities.

□ *The auto has paved-over our cities.* He makes two points here: First, the amount of city land devoted to expressways is less than 5 per cent, and less than 1 per cent in those older cities where land is scarce, e.g.,

New York or Philadelphia. Second, we must remember that the area devoted to ordinary city streets was designated for that purpose *before* the development of the city began. "Indeed, these streets made possible the development. It is not that the highway is devouring the city, but that the highway creates the city."

□ *The auto is subsidized.* He points out that from 1920 to about 1970 highway taxes and highway expenditures were *equal*, there was no subsidy; and since then inflation has created only a small imbalance — about \$42 per car per year in 1974 (compared to a yearly subsidy of more than \$3,000 per rail commuter, which my own research indicates, for a modern system like BART in San Francisco).

Though Bruce-Briggs does get carried away by his own arguments on occasion — as when he criticizes auto safety regulations and attacks the congressionally-mandated fuel efficiency standards as being "ridiculous" — I have no doubt that the major thrust of his argument would win approval from the great majority of academics who study transportation problems.

My personal conclusion is that our transportation problems have defied solution because we have misconceptualized the question: we have cast the automobile as inherently evil, public transportation as

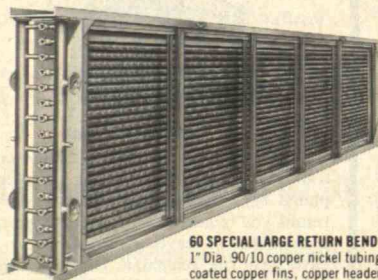
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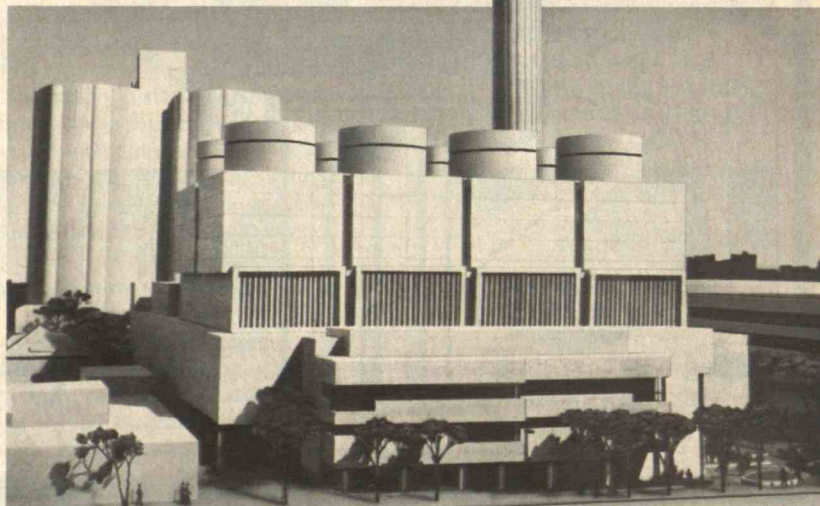


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inherently good, and hence have been totally preoccupied with the task of diverting people from cars onto transit. We have tried subsidizing fares (passengers are currently paying only about half of the operating cost in most cities); we have tried priority treatment for buses; we have doubled bridge tolls and parking fees. None of these changes has had much effect: transit, in general, carries only about 2.5 per cent of our daily trips. Even heroic efforts by some cities have been fruitless: San Francisco spent more than two billion dollars to create a fast, comfortable, attractive modern rail transit system — but it only carries 2 per cent of the trips in the area; and it has lured most of its passengers away from buses, not cars. I know of no one in the transit industry who seriously proposes that there is any combination of feasible measures which could raise transit's share of total trips to a figure as high as 10 per cent by the end of the century.

Civilizing the Car

The only feasible substitute for the present automobile is some other kind of automobile, one which still preserves people's auto-mobility: that goes where they want to, when they want to, in the same door-to-door time. These are the features that must be preserved if we are

trying to design a car-substitute; and it is the absence of these features which will always operate to keep transit's share of total trips so low. If people insist on individually scheduled commuting, in diverse patterns across the city, then give them that mobility, but do it in an inoffensive car. If we cannot get rid of the car, then let's try to civilize it instead. Allow me a simple example.

In 1976 Los Angeles voters were asked to consider a modern rail transit system that would have cost about ten billion dollars. The planners forecast that this might divert as many as 140,000 people per day out of cars. Big deal.

Let me suggest an alternative solution to the congestion/energy/smog problem in Los Angeles. Three simple steps: 1. paint new, narrower lanes on all existing freeways — new line markings to be a different color from the conventional markings, to make them distinguishable, and the new lanes to be only two-thirds as wide. Hence four conventional lanes become six new narrow lanes, and highway capacity is increased by 50 per cent by a simple stroke of the brush. 2. We make one new traffic regulation that says: during the morning and evening rush hours only small cars are permitted on the freeways. The narrow lanes are wide enough for these cars to use safely. 3. Since the second step would create a large number of

screaming commuters, protesting their inability to drive, we now placate them by giving each and every one a mini-car to drive. Free of charge. And all for less total expenditure than the proposed rail transit system (\$3 billion instead of \$10 billion).

This is not an argument to abandon public transportation: transit will always be necessary for a few very dense cities, and for some population groups in all cities; and we do have to provide it.

But we should abandon our efforts to fight the public's taste for auto-mobility, and work with them instead. A car does not have to look like a cabin-cruiser on wheels, nor does it have to use petroleum, emit harmful pollutants, or even use large amounts of energy.

Charles A. Lave, Ph.D. in economics from Stanford, is chairman of the Program in Economics and Public Choice at the University of California, Irvine. He has worked extensively in the area of human factors in economic problems; the demand for public transportation; and comparative energy analyses. □

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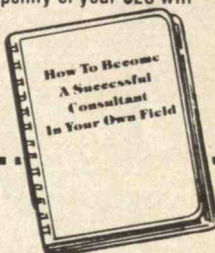
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Arcosanti: A New Dream Out on the Desert

Paolo Soleri has set out to prove that cities can be quite different. On a dusty mesa north of Phoenix, he has begun to build an oasis of culture and agriculture.

The key to making cities instruments of progress rather than models of decline is to integrate all of their systems, says architect/philosopher Paolo Soleri. On but 13 acres of an 860-acre tract, he proposes to build a 25-story prototype that will house about 5,000 people and all the needed support systems.

Soleri believes that cities are the environments for the cultural and spiritual evolution of humanity; but he insists that their architecture be firmly based on ecological principles. "Instead of picking up one problem at a time and trying to solve it, we are trying to find a whole solution," he explains. Arcosanti, the first "arcology" (Soleri's word), is now six buildings and several arches that grace a desert mesa 70 miles north of Phoenix. This will be shadowed by a second design, the Two Suns Arcology, which has benefited by research into "new age" technologies and architecture by Soleri's associates in the Cosanti Foundation.

"New Age" Technology

The plans for the Two Suns Arcology, completed about three years ago, show that it will take greater advantage of new developments in solar energy than the first, cathedral-like model. Two Suns will be "energized by the sun," grow its own food, recycle its waste for agricultural nutrients, and have its own, largely self-contained economic system. While Arcosanti would employ some sophisticated hardware, Soleri emphasizes that "the

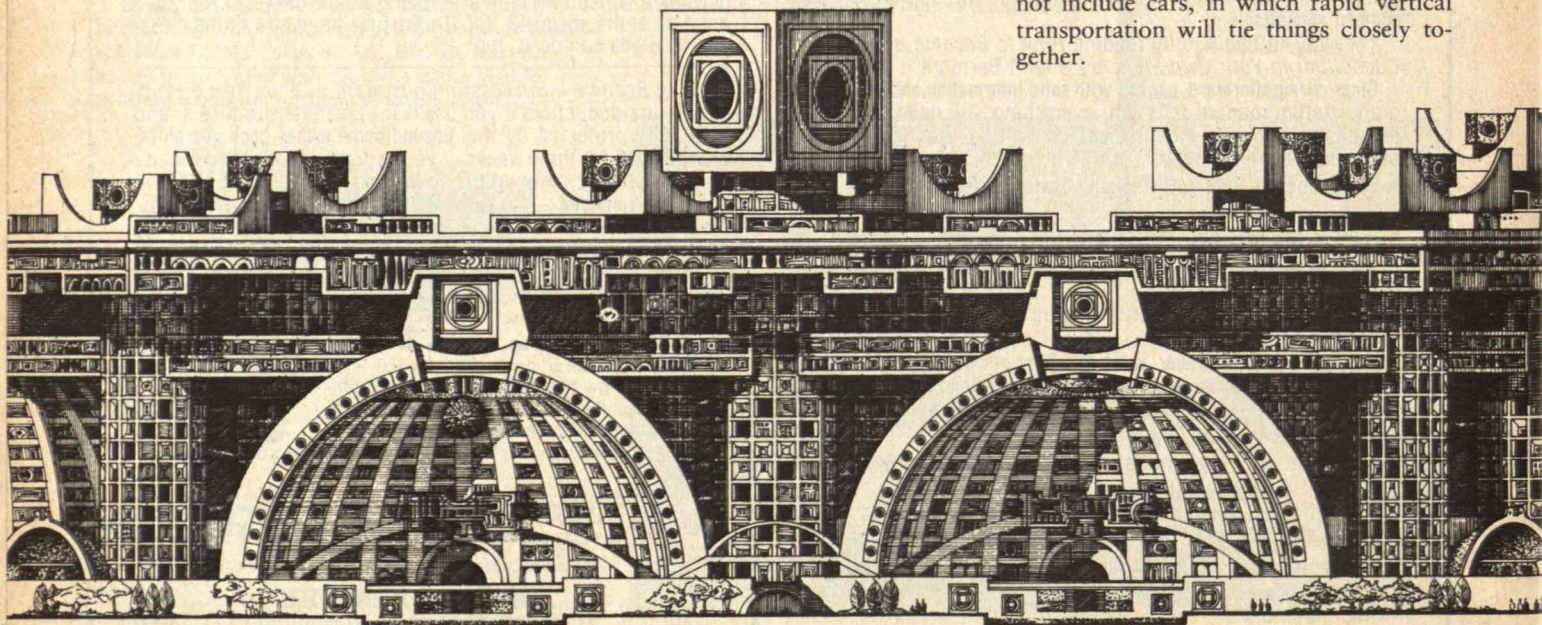
application of the technology will be very different."

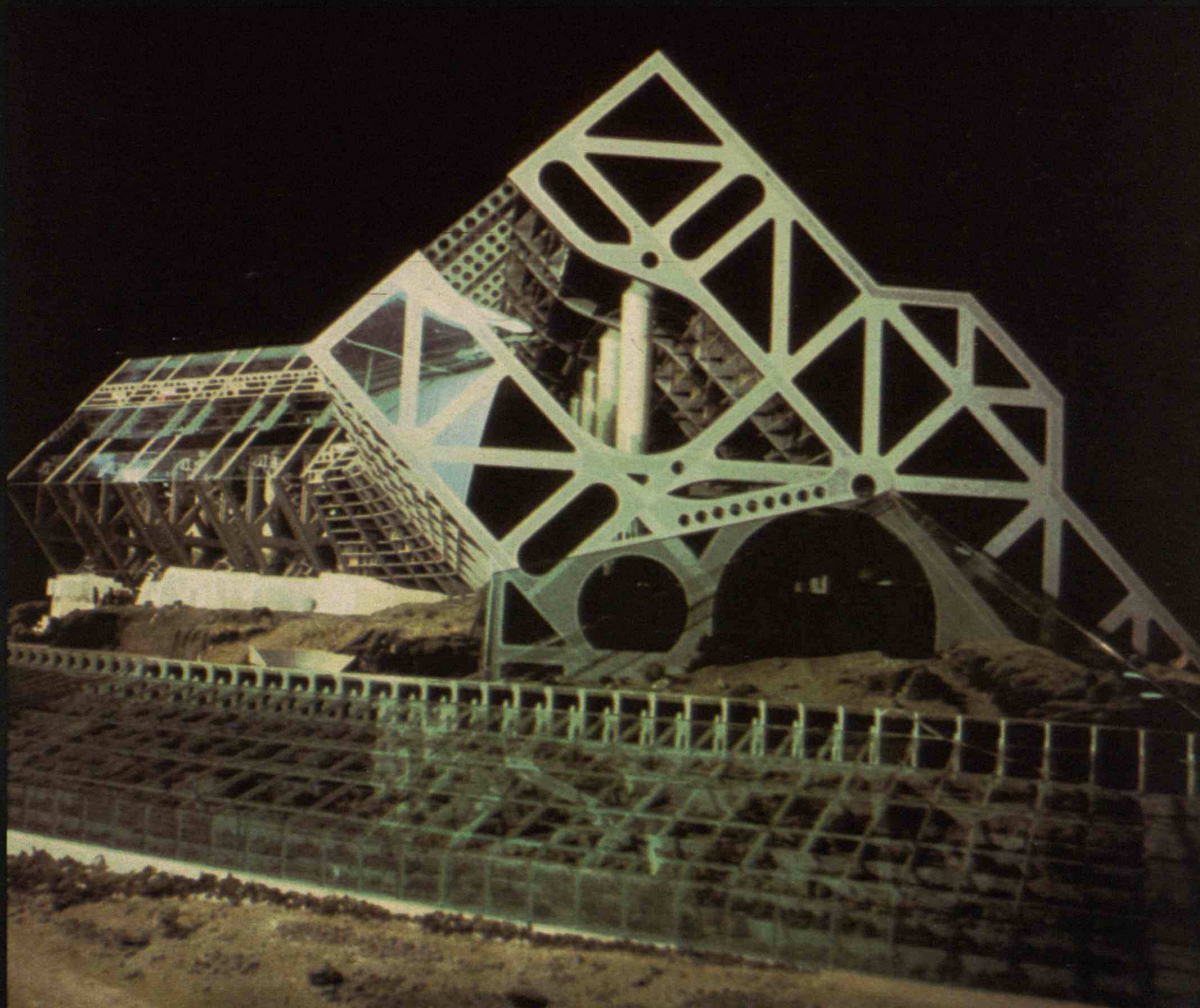
The hemispheric-shaped building will face south; its roof and structural overhangs tilted like two "blades" which will act as huge, passive solar collectors during the winter months when the sun is low in the sky and as providers of shade during the summer months of high sun.

Five acres of greenhouses will stretch from the mesa to the canyon below. In addition to supplying food, their placement will take advantage of what Soleri calls "the chimney effect," in which rising columns of air within the greenhouses would be channeled to provide for space heating needs. Using computer time donated by Control Data Corp. of Minneapolis, Cosanti Foundation researchers have begun to devise complex mathematical models of how the greenhouses will work, including calculations of water consumption and recycling.

Connected to the greenhouses and sanitary facilities will be a wastewater reclamation system to recycle sewage for use in agriculture and perhaps eventually for drinking. One such system under consideration uses water hyacinths to reclaim waste and is being operated as a demonstration project in Cardiff, Calif., by Solar Aquasystems, Inc.

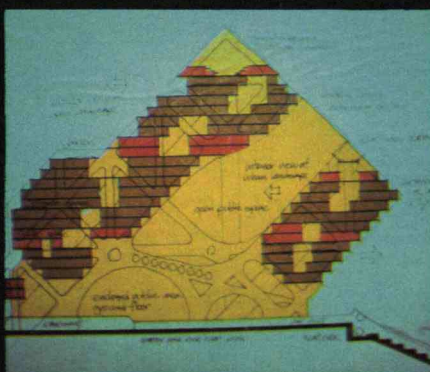
It's assumed that electrical energy will be provided by whatever solar-cell technology is available at the time of major construction. The specifics of Two Sun's transportation network have not been worked out; but as an outspoken critic of the "asphalt nightmare," Soleri has designed a miniaturized city that does not include cars, in which rapid vertical transportation will tie things closely together.

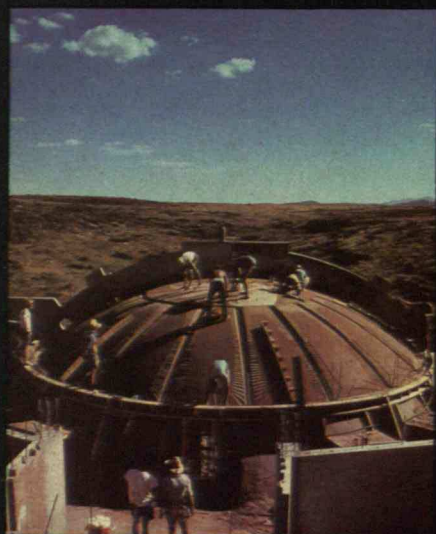




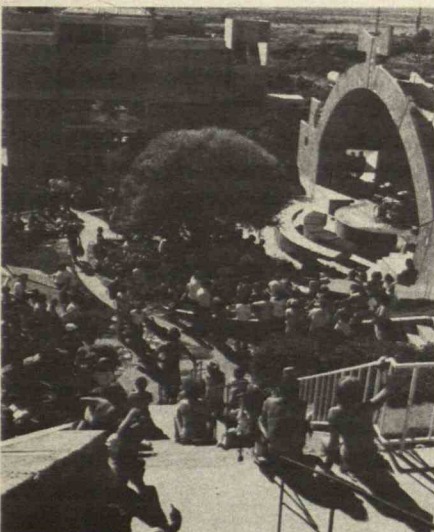
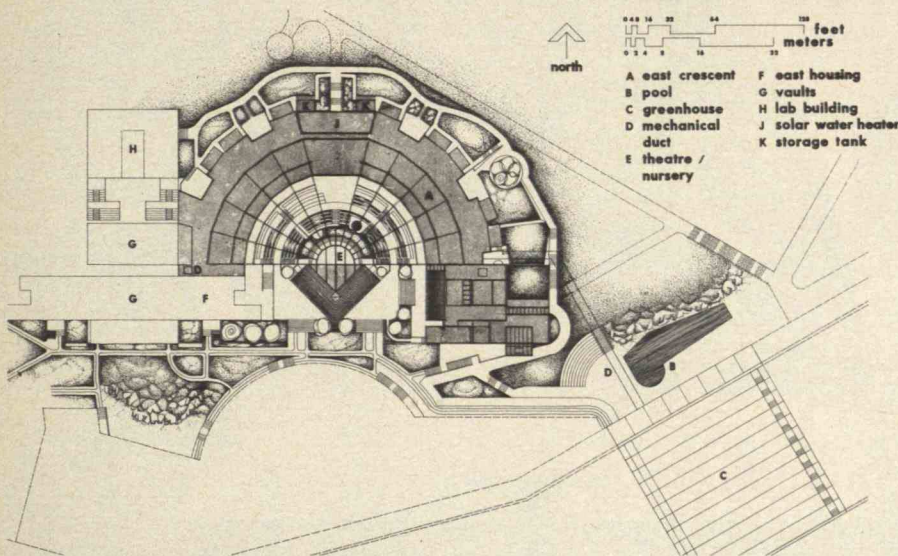
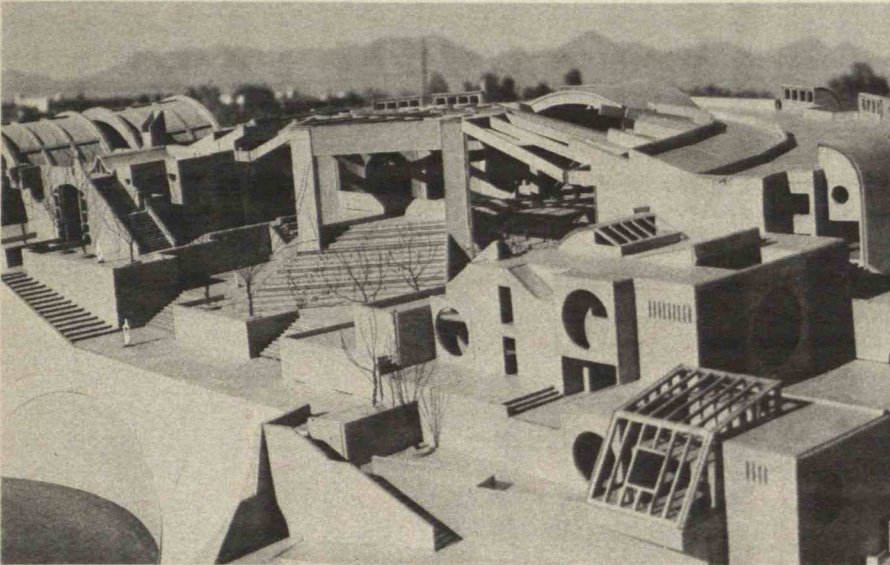
The design for Arcosanti has evolved from Paolo Soleri's early neo-Gothic sketch (left) to the Two Suns Arcology (above). While the first model made abundant use of the south-facing apse — a quarter sphere which takes advantage of low winter sun and provides shade in summer — the new model emphasizes solar technologies and features five acres of greenhouses to supply food and heat for the 5,000 people who will live in the one-roof city. At right, Soleri and assistants study plans. (Sketch: *The City in the Image of Man*, M.I.T. Press)

Photos by Gregory Dennis and Ivan Pintar





Construction began in 1970, but only a few structures stand on the desert mesa 70 miles north of Phoenix. They are the hard-won evidence of thousands of student and volunteer workers who hauled rocks, shaped the flowing concrete forms in riverbed silt, and poured bronze for bells which provide partial economic support for Arcosanti. Pictured above: Crafts-3, which houses a visitor's center, restaurant, art gallery, and temporary housing; the foundry apse; and the South Vault, the entrance to the future city.



Construction of the award-winning East Crescent will begin late this year. This will be the testing ground for the greenhouse, heating, and water-gathering technologies planned for the Two Suns Arcology. It will also provide housing, a pool, and amphitheatre for the cultural activities so essential to Soleri's principle that the city be the focus for a spiritually evolving humanity.

A former student of Frank Lloyd Wright — the master eventually threw him out — Soleri contradicts architecture's fundamental dictum that form follows function. Traditional thinking has it that if you want a building to serve a particular purpose, you build it in a particular shape. Soleri holds, however, that it's possible to build forms which are in themselves interesting and beautiful — and that they will turn out to serve a variety of purposes limited only by the imagination of those using them. As Cosanti architect Jeff Stein puts it, "Extraordinary places create extraordinary events."

One example is the Arcosanti foundry apse, completed in 1975. It's one of several cottage industries that provide partial economic support for construction through the sale of bronze windbells made there. But in addition to bellmaking, the foundry has been the site for press conferences, speeches, dance performances, meals, and art exhibits — accommodating all with ease.

Borrowing from the technique used to produce ceramic bells at Arcosanti, the six buildings now completed were made largely from pre-cast concrete poured in forms shaped from local riverbed silt. Construction head Tony Brown calls it "a great way to produce very complex shapes with unskilled labor." While that technique will continue to provide some of the arcology's more elaborate forms, it will need to be supplemented by more conventional ones when Two Suns is built.

Though Soleri's holistic approach suggests intriguing possibilities, designing and building the main structure of the arcology awaits massive funding. Some of the technological systems proposed by Soleri will have their first real test in the East Crescent building planned for construction in 1979-1980. A unique multi-use structure, the crescent received a design citation from *Progressive Architecture* magazine this year. As a microcosm of the larger structure, East Crescent will have a small greenhouse built below it. Collectors will capture rainfall for use within the building. A spaceheating system connected to the greenhouse will test the practical application of the chimney effect in heating the 12 residential units. In addition to housing, the crescent will contain a 500-seat amphitheatre which will double as a play area and marketplace.

Both Soleri and his critics insist that the proof of his idea must be found in the building: if arcologies don't work as efficient and pleasant environments, then the ideas behind them are wrong.

But Arcosanti and Soleri's philosophy

can be viewed in another way than as a design that either works or doesn't. It is a conception of a life that ties men and women to their natural surroundings that also recognizes the need to do something more with one's intelligence than merely going back to the land.

Living Within the Dream

Except for the week of its annual festival, Arcosanti looks more like a cultural backwater than a bold thrust into the future. Here's a bunch of several hundred people who actually believe their lopsided buildings of sand and concrete are the living environment of the next century. They have no money, little engineering expertise, and irreverent ideas about architecture and technology.

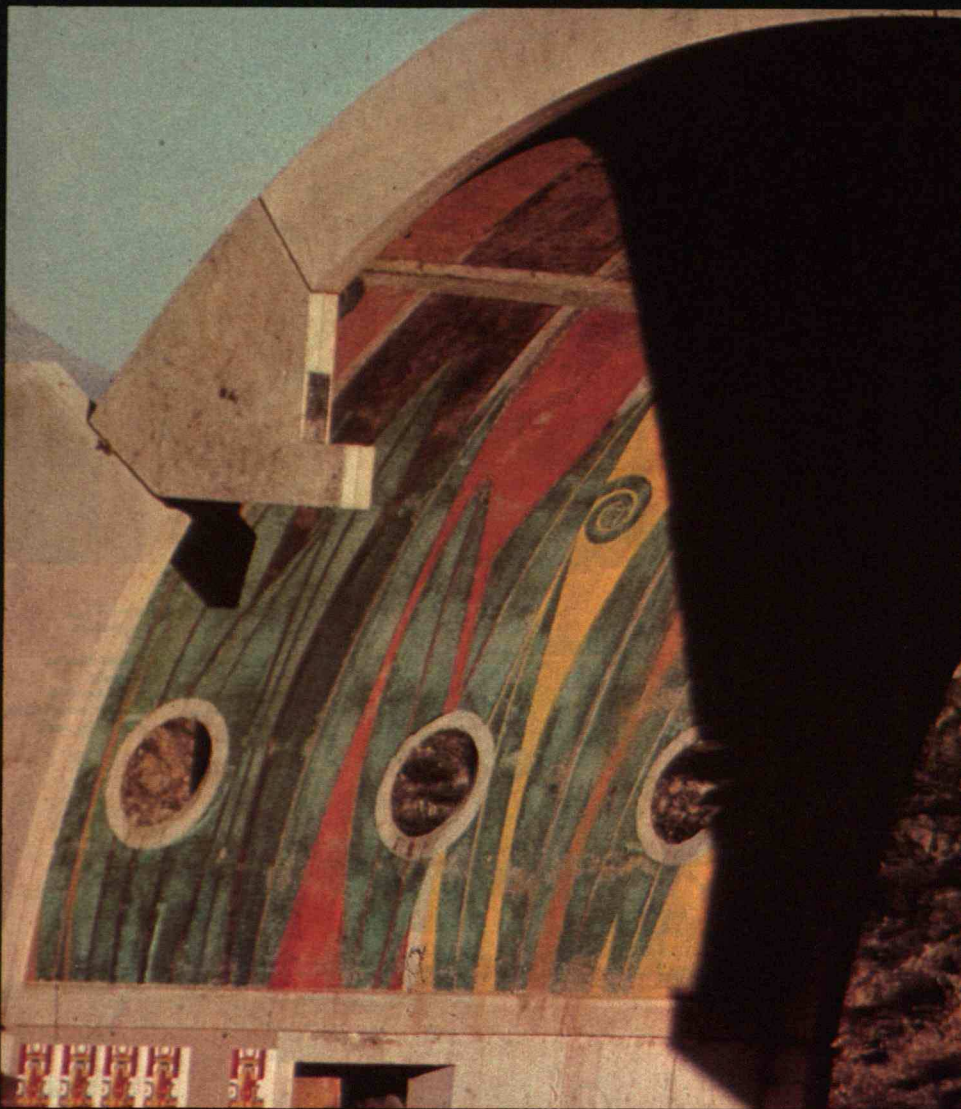
But if you're living and working at Arcosanti, growing older and a little wiser with people who haven't settled for an ordinary life of ordinary compromises, the dream begins to make a lot of sense. For a time I shared the dream day-to-day with Soleri and friends at Cosanti, and up north at the construction site. Even pouring 1,800-degree bronze in the middle of a summer scorcher was fun.

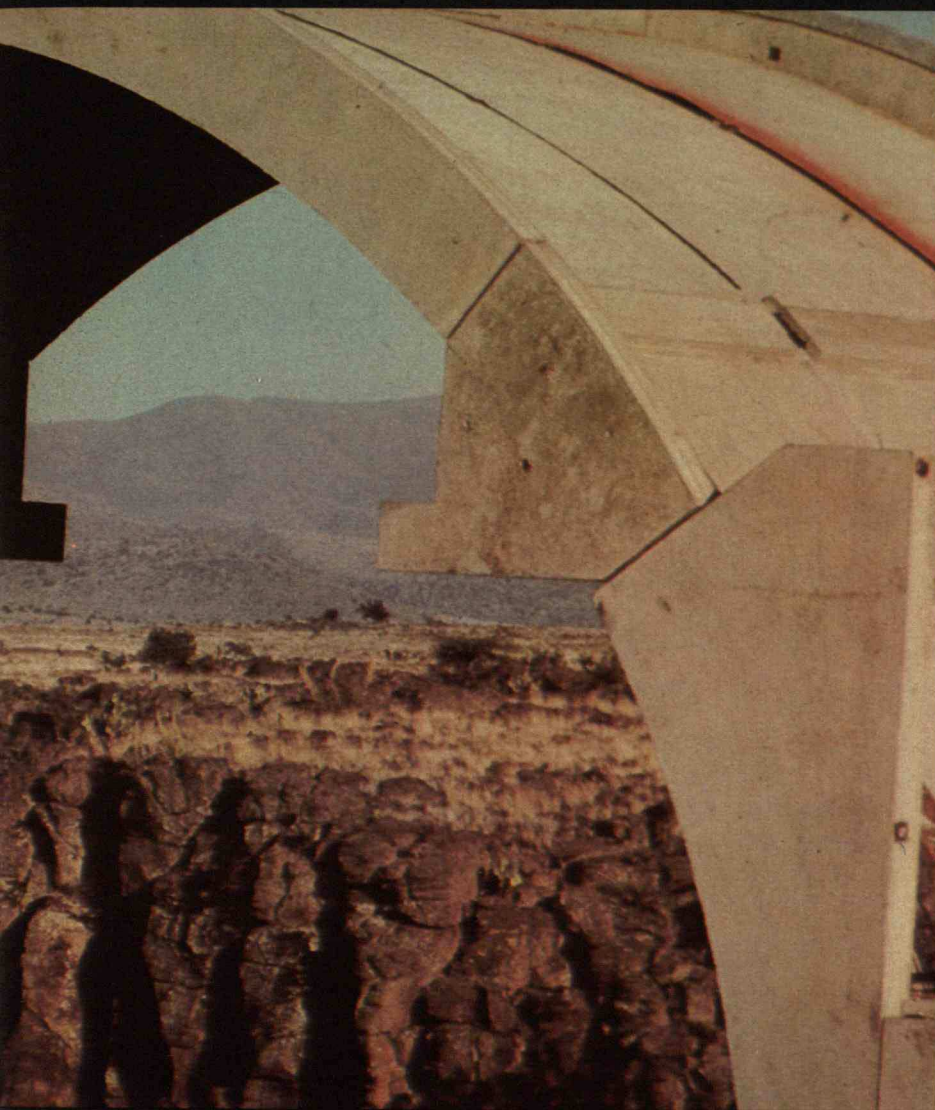
Arcosanti is worth it for the aesthetics alone: nights when the sky burns with sapphire stars and meteors whiz by. . . . mornings when you can feel your life in your hands, real as the dust. . . . rolling mesas and the Agua Fria river when its path is suddenly choked with the muddy mess of a cloudburst.

I met there the strangest cast of characters I've ever encountered: counter-culture gurus and rejects, mechanical mavens somehow able to stir to life the few pieces of creaky machinery, students buzzing with ideas and always ready for an impractical trip or practical joke, tale-spinners readying for an oldtime liar's contest, and one guy who would go up into one of the box canyons and bounce the melodies of his saxophone off the towering walls.

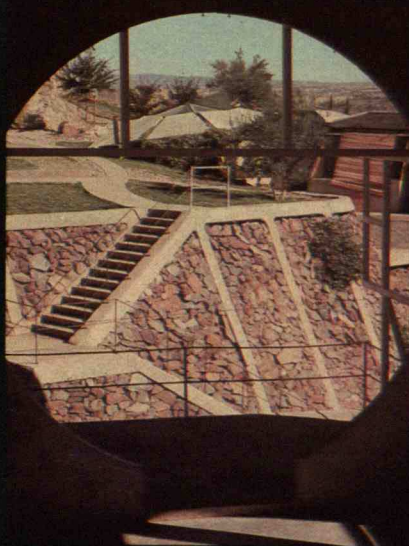
And Paolo, himself, everyone's touchstone. On his frequent visits to the site he would trudge intently, his high forehead wrinkled, ringed by Caesar-like hair. Most accounts of Arcosanti focus on the discipline-like devotion accorded Soleri. But there he becomes many things: a genius madman, a whimsical taskmaster, a warm and funny old man, a pain-in-the-ass whose visits are sometimes dreaded by the construction planners, and a Socratic in the midst of his very own forum.

As a member of the foundry crew at Ar-





The expansive entrance arch to Arcosanti now greets only the determined visitor. Though Soleri is determined that feasibility and design should not be guided by economics, its completion date will be. With scant funds and so vast an undertaking, Soleri and followers have begun to admit their dream may be left for future generations to fulfill.



cosanti I was one of the elite: I got paid. A few of the oldtimers drew a small living allowance. But most everyone else was a "workshopper" who had paid about five hundred dollars for six weeks of moving rocks and running bulldozers, helping in the camp kitchen, pouring the graceful concrete forms for buildings, and the occasional treat of listening to Paolo discourse on architecture and evolution. During my stay, for instance, one weary group spent a week piling boulders for a stone wall below a building that houses apartments and the Arcosanti Cafe. (On an ordinary construction site where labor intensity was not the rule, the job would have been handled in a day by one man and a backhoe.) Another group laid insulation and a roof that they were sure was going to end up leaking because there wasn't the money to do it right.

Persistent Pioneers

Arcosanti is at present not one community but two: the core group of about 40 individuals, including a couple of families who have committed these years of their life to the project; and the ever-changing community of workshopers stopping off on the way to their own futures to share in a larger one. After four months of foundry work I moved on. In hopes for journalistic respectability, I was soon back sitting at a typewriter instead of a metal grinder.

So nothing in the interim between my stay there and my return two years later to Arcosanti Festival '78 had prepared me for what I found. Little major construction had occurred, but still there was the same persistent band of pioneers, most of whom had spent the intervening years there and showed no signs of leaving. As one friend who's raising his family there said to me, "I'll spend my life here."

At age 60, Soleri has begun to acknowledge that his city-in-the-sky may not be completed in his lifetime. But his vision of a human environment that produces its own resources, rather than eating up someone else's, is in our future. It is Soleri's insistence that man must evolve cities that give new life to the land and to the people in them. It's also what made life out there in the high desert, in our own little Spaceship Arcosanti, so heady an experience. □

Gregory Dennis is a writer and photographer living in Encinitas, Calif. He spent four months in the summer and fall of 1976 working at the foundry at Cosanti and Arcosanti, and returned for the Arcosanti Festival in the fall of 1978.

IT'S ABOUT WE LEARN LIS

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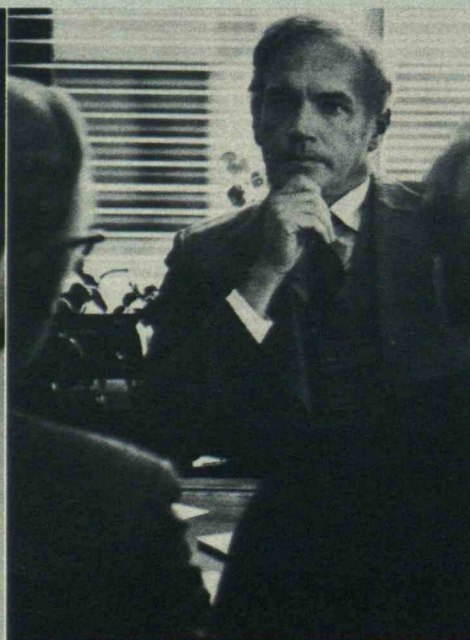
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Synthetic Fuels at the Crossroads

by Charles A. Stokes

The technology for a major new synthetic fuel industry is now available, awaiting only our resolve to get on with its exploitation.

The energy supply situation in the United States currently and looking forward is extraordinarily complex. Environmental control alternatives, changing environmental laws and regulations, legislation on fuel priorities, taxes and other incentives, changing costs of energy sources, transportation alternatives, political biases, public attitudes, the supply and prices of petroleum and natural gas, the relative economics and reliability of existing and developing processes for alternative fuels — all these are among the factors which lead to future uncertainty.

Even if we consider only the single issue of fuels which may be alternatives to our present heavy re-

liance on oil, the complexity remains. Congress and the president could vastly change the economic outlook for synthetic and alternate fuels in a short period; for technological research to do so will require many, many years of often frustrating research — frustrating because the laws of chemistry, physics, and thermodynamics often work against us and because the economic environment in which these products must succeed seems constantly shifting, like quicksand, under the researcher.

My assignment in this article, which I accept with a combination of awe, humility, and tongue in cheek, is to try to answer two questions: To what degree may the several alternative fuels and processes (including synthetic fuels) now known to us be exploited to reduce our heavy dependence on oil and gas in the short term — say through about 1985 — if domestic policies and international political actions do not foreclose the opportunities which technology may offer? And what is new research and development likely to permit us to do after 1985?

To make this a manageable task, and the result comprehensible to you, I can only hit a few high spots which may illustrate the kind of programs that are likely to be carried out. Though I may miss on the exact content of the future (please allow my crystal ball some reasonable number of mistakes), I will at least have focused on those options that are really open to us on the basis of time, cost, and practicality, and that alone will be an important contribution to your understanding of present and future policy.

Reducing Our Thirst for Oil

Looking ahead, I am more comfortable with the broader term “alternative fuels” than with the narrower terms “synthetic fuels” and “alternate technologies.” This is because we must consider a range of technologies and products to replace petroleum and natural gas as supplies of the latter dwindle and/or international problems lead us to seek domestic resources.

One group of alternatives involves direct combustion of coal in place of oil. This will require use of advanced technologies for removing oxides of sulfur and nitrogen (SO_x and NO_x , respectively) from

the stack gas; fluidized-bed combustion of coal in the presence of limestone, which seems to be a promising technology for controlling sulfur and nitrogen oxides during the combustion process; or second-generation systems for removing sulfur (for example by leaching) from coal before combustion.

Alternatively, we may choose to exploit processes for producing low-heat-value gas (150 B.t.u.s per cubic foot), medium-heat-value gas (300 B.t.u.s per cubic foot), or methane (1,000 B.t.u.s per cubic foot) from coal; for producing crude oil more or less usable in existing refineries from oil shale; and for producing various hydrocarbon liquids, including methanol, from coal, lignite, or peat.

All or most of these alternatives will be required if we are to make a significant dent in U.S. dependence on imported gas and oil by 1985 or even by the year 2000, and events continue to suggest the importance of this goal. There is now no way for us to obtain on short notice 2 or 3 million barrels a day of synthetic crude oil or any other equivalent replacement for today's imported oil. Starting right now with existing technology and no regard to economics, a program to achieve capacity for that amount of replacement fuel would take \$100 to \$150 billion and ten years.

Recent trends indicate that the U.S. synthetic and alternate fuels program may finally be underway on a more nearly commercial scale, although massive production programs are certainly not in the offing. Had action started more promptly after the 1973 embargo we might have seen pioneering commercial plants onstream this year or next. Instead, we will probably have a few fairly large demonstration plants and a few "pioneer commercial" plants by 1985, accompanied by some streamlining of research and development. These will be supported by gradual easing in price controls on petroleum products and some increase in incentives for commercialization. Whenever these plants enter commercial service, the familiar "learning curve" process — which has been so enormously beneficial to industry when manufacturing everything from electric ranges to ethylene — will begin; these plants will also serve to focus further research on highly specific needs for improving the efficiency of the processes.

But with that program still unrealized, the outlook for the next few years must be based largely on existing technology.

What is our inventory of available or nearly available new technology ready for commercialization in time to reduce our demand for petroleum by 1985?

Cleaning Up Coal Combustion

Conventional coal combustion now depends on effective technology for removing SO_x and NO_x from stack gas. We now have one advanced SO_x removal system in commercial use in the U.S. — the so-called Wellman-Lord process (*see box*) which has the significant advantage of reducing the collected SO_x to marketable sulfur, though it does not deal with the NO_x in the stack gas; other commercial processes now in use for cleaning stack gas are not fully regenerative: the SO_x appears in an unpurified waste sludge. This Wellman-Lord process is in commercial use at the Mitchell Station of Northern Indiana Public Service Co. in Gary, Ind., and two more units are underway.

The Shell flue gas desulfurization (SFGD) process for simultaneous removal of SO_x and NO_x from stack gas (the sulfur once again can be recovered) is surely the ultimate answer, and it should also be in use on one or more coal-fired plants of several hundred megawatts capacity in the 1980s. This process has operated commercially on an oil-fired boiler in Japan for several years, and it has successfully removed SO_x in the presence of fly ash in the stack gas from a coal-fired boiler in a test conducted in the U.S. It is just becoming available commercially here.

Companies installing such stack gas treatment systems now qualify for a 10 per cent investment credit. A more adequate incentive is contained in the proposal to double such credit, giving a total credit of 20 per cent which can be taken during construction. If, in addition, the user could take depreciation in as little as 15 years, or perhaps even 10 years, on the basis of corrosion and obsolescence factors, and if he could count on a market for the recovered sulfur, there would be a powerful incentive to incorporate this technology and substitute coal for oil when utilities need new boiler capacity between now and 1985. But few installations will occur until two further requirements are met:

□ The laws requiring conversion to coal and those based on the 1977 environmental legislation must be clarified in at least two respects. As now written, this legislation requires substantially complete removal of sulfur from the stack gas, regardless of the sulfur content of the fuel; this is a difficult and unnecessarily severe constraint. And the final limit on NO_x emissions remains unclear.

□ Adequate supplies of coal must be assured at prices well below those of clean petroleum fuels.

It is reasonable to expect that these conditions will

Cleaning the Emissions from Coal-Fired Boilers

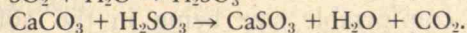
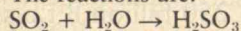


Three major air pollutants which result when coal is burned now bedevil those who would replace oil with coal as fuel for large industrial installations: particulates, oxides of sulfur (resulting from the sulfur content of the fuel), and oxides of nitrogen (resulting from the nitrogen in the combustion atmosphere).

Mechanical filters, electrostatic precipitators, and "wet scrubbers" — filters composed of jets of small water droplets — can all be made effective for removing particulates.

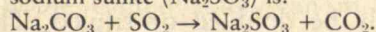
At least 60 different processes for removing oxides of sulfur (SO_x) can be identified in the patent literature. Among these, most attention is focused on those which can be combined with particulate removal in wet scrubbers. In general, these can be grouped according to their reliance on one of four chemical reactants:

□ Oxides of calcium — usually limestone (CaCO_3) — react readily with sulfur dioxide (SO_2 , the common form of SO_x), to form calcium sulfite (CaSO_3), which is insoluble (though apparently innocuous) and considered a disposal problem. The reactions are:



□ Magnesium systems, chemically analogous to the calcium-based systems, used magnesium hydroxide ($\text{Mg}(\text{OH})_2$) to yield insoluble magnesium sulfite (MgSO_3). But MgSO_3 is more tractable than CaSO_3 ; when heated, the former yields magnesium oxide to be recycled into magnesium hydroxide and purified sulfur dioxide which is itself a useful chemical raw material.

□ Sodium compounds are now more successful than either calcium or magnesium in similar chemical systems. A typical reaction involving sodium carbonate (Na_2CO_3) to yield sodium sulfite (Na_2SO_3) is:



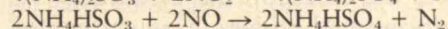
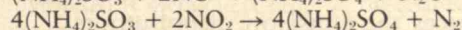
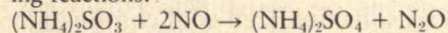
The process can then be reversed to yield a portion of the original SO_2 as liquified sulfur dioxide.

The Wellman-Lord process (see page 26) incorporates this sodium chemistry in a more complex and highly efficient system which delivers the vast proportion of the sulfur originally contained in the stack gas as a concentrated stream of sulfur dioxide. The latter can then be converted into sulfuric

acid, elemental sulfur, or liquid sulfur dioxide — any one of which has commercial value which can be exploited to help meet the operating cost of the recovery system.

□ Ammonia-based systems seem to be competitive with most of the alkali metal systems, partly because the regeneration product — ammonium sulfate — is a marketable chemical.

The NO_x discharges from the combustion of coal or oil are commonly mixtures of nitrogen dioxide (NO_2) and nitric oxide (NO); the latter reacts with atmospheric oxygen to form NO_2 , which can be observed as a brownish haze. The difficulty of removing NO_x from stack gas hinges on the fact that these pollutants are 1,000 to 2,000 times less soluble in water than SO_x . Conventional wet scrubbers by which SO_x and particulates can be controlled simply do not work well to manage NO_x . Sodium-based systems are effective in removing NO_x if SO_2 is not present, but this is almost never the case. Ammonia-based systems using ammonium sulfite ($(\text{NH}_4)_2\text{SO}_3$) and bisulfate ($(\text{NH}_4)\text{HSO}_3$) appear to offer a practical means for removing NO_x , according to the following reactions:



The resulting nitrogen (N_2) and nitrous oxide (N_2O) are readily used or disposed of; but the ammonia-containing products present a disposal problem.

□ Dry systems which combine absorption and catalytic action such as the Shell flue gas desulfurization (SFGD) process, are surely the ultimate answer. In this process copper, introduced as copper oxide, accepts the sulfur to become copper sulfate; the sulfate is reduced to copper with impure hydrogen, and the sulfate can be reduced to sulfur with natural gas. Meanwhile, the copper released from its sulfate flashes back to copper oxide as soon as flue gas hits it. Thus the cycle is complete.

If ammonia is injected, NO_x is reduced to harmless nitrogen. Heat is evolved as the copper oxide accepts the SO_x , with the result that the process consumes less than half the energy required by wet systems such as those above. □

Cleaning Coal Before Burning It

Removing contaminants from coal before burning it involves chemical separation processes which in effect break the coal down into many of its constituents and then reconstitute it into a product which has most of the advantages and almost none of the disadvantages of the original coal. Seven process steps are involved:

- The coal is washed and pulverized.
- The pulverized coal is mixed with a hydrocarbon solvent.
- The hydrocarbon/coal mixture is reacted with hy-

drogen at high temperature (482° C) and pressure. Some 90 per cent of the carbon in the coal is dissolved into the solvent, and organic sulfur in the coal is converted into hydrogen sulfide.

□ The ash is removed from the carbon/solvent mixture by filtration, and the solvent is recovered by drying and distillation.

□ Hydrogen sulfide is removed from the gas stream by conventional chemical processes.

□ The carbon remaining after drying is turned into flakes suitable for combustion in conventional coal furnaces with minimal modification. □

be met and that several commercial installations will be made in the 1980s, particularly in new plants, to begin the process of reducing our dependence on oil by using coal with advanced stack gas cleaning.

Combustion of coal in a fluidized bed is a promising new technology nearly ready for commercial use. In briefest summary, millimeter-size coal particles are burned in a hot bed of limestone particles which are kept in constant "boiling" motion by a blast of air introduced through a perforated plate that supports the bed. The bed temperature is relatively low, and the limestone acts to absorb sulfur released from the coal; for both reasons fluidized coal combustion significantly reduces the emission of pollutants.

Commercial fluidized-bed boilers large enough to produce 100,000 to 500,000 pounds of steam (10 to 50 megawatts of power) will be available within three years and can probably be ordered now if one is willing to bend a little on guarantees; it is perhaps being conservative to allow even as long as three years to shake down the technology. But fluid-bed boilers for large utilities — 400 megawatts and over — are surely eight or ten years away if indeed they are ever to be used; pressurized fluid-bed combustors used with gas turbines may prove a better answer for future power generation.

An alternative for meeting air-quality standards in the use of coal is to remove contaminants by chemical processes before the coal is burned. Two plants pioneering this solvent-refining process (*see box*

at left) are now in preliminary engineering and will come on stream in four or five years, barring delays due to environmental regulations or a change in the current positive government attitude toward this process. These units would be either full-size commercial modules or "pioneering plants" of at least half this size.

Such a "pioneering plant" represents an interesting new strategy that has come into our planning; it usually is taken to mean a plant larger than that needed to demonstrate a particular technology but too small to achieve minimum operating costs. Such plants may be an important intermediate strategy for proving technology under unfavorable economic conditions.

Turning Coal Into Gas

Enough has been published now on the technology of producing industrial fuel gas (nominally 300 B.t.u.s per cubic foot) from coal to fill a good-sized library, and a number of processes are available (*see box at right*). Gas with a value of 280 B.t.u.s per cubic foot can be made with current technology at an overall efficiency of 70 to 80 per cent, including the energy requirements of the associated oxygen plant. The problems are only two: the price gap between this fuel gas and natural gas, and the persistent dream that some magic second-generation technology will change everything.

But I see this dream rapidly fading, so I suggest that by 1985 there may be as many as five large plants using coal to produce 300-B.t.u. gas. These would range in size from 25 to 250 billion B.t.u.s a day, with a comfortable size being in the 100-billion-B.t.u. range. Two of these would be government-backed demonstration plants and the others would be built with private capital and government assistance in the form of tax credits, accelerated depreciation, loan guarantees, and possibly fuel price subsidies that would disappear in time. Only modest inputs are needed from on-going research, and if the government mounted a sensible and effective commercialization program, these numbers could easily be doubled or tripled. The capital cost of such plants will be between \$8 and \$12 per annual million B.t.u.s produced, in terms of dollars actually spent between now and 1985. If we assume that in 1985 the coal may cost \$1.25 per million B.t.u.s delivered, the gas may cost \$4.5 to \$5 per million B.t.u.s; and if such plants turn out to have 25 per cent more capacity than designed

(which is by no means beyond imagination), this would lower gas cost by perhaps 10 per cent. This prospect is more exciting than a 5 per cent increase in thermal efficiency.

This 300-B.t.u. gas will first find use in industrial plants with a large inventory of gas-fired heaters and boilers that will otherwise have to be replaced as natural gas rises in price due to scarcity or is legislated out of use as an industrial fuel. These will be in locations with a favorable coal supply — either adjacent to Texas lignite mines or accessible to coal delivered cheaply on the Missouri-Mississippi-Ohio River system. These plants may initially use western coal, but eventually they will become the “garbage cans” for poor quality coal, particularly high-sulfur coals.

In the field of producing low-B.t.u. gas (150 B.t.u.s per cubic foot) from coal, a number of very small government-sponsored commercial plants are coming on stream, all using existing technology which also is very old. It is not at all likely that this kind of technology will be important again; the units are just too small. Even if 50 or 100 such plants were built, their total output would be in the range of 25 to 100 billion B.t.u.s a day, and one modern industrial fuel gas plant could do as well at far less capital cost.

There is a place, however, for low-B.t.u. gas made by modern technology. Several plants will be built by 1985 to produce 150-B.t.u. gas for combined cycle plants, where the gas will be used to drive a gas turbine and its waste heat used to raise steam for a conventional turbine. Other plants will be built to provide clean gaseous fuel to large boilers for industrial heat.

The final area for early commercialization is the production of synthetic natural gas (nominally 1,000 B.t.u.s per cubic foot) from coal. Here we expect to see several plants based on western coals ranging in size from 80 to 250 billion B.t.u.s a day by 1990; all will require either government assistance or at least favorable rulings to utilities on gas pricing. These will be based on existing technology or at most evolutionary improvements on it.

If the United States can in fact accomplish by about 1985 a modest program for coal gasification such as that outlined above, a solid base would have been built under alternate and synthetic fuel technology to assure massive expansion by the year 2000. This would utilize many improvements now being researched and slated to be tested in various government programs in the next five years. We are



Making Gas From Coal

One million cubic feet of pipeline-quality (1,000 B.t.u.s. per cubic foot) gas from 80 tons of coal is the daily capacity of this \$10.5 million “Hygas” pilot plant at the Institute of Gas Technology, Chicago. A full-size plant using this process might produce 250 million cubic feet of gas per day; more than 200 such plants would be needed to meet current U.S. natural gas requirements. (Photo: Institute of Gas Technology)

As far as energy is concerned, the significant constituents of coal and air are carbon and oxygen.

The familiar reactions between these constituents are those of combustion, which represent virtually complete oxidation of the carbon, yielding heat and noncombustible gases. In contrast, the principal oxidation reactions used for coal gasification consume heat rather than yielding it and produce gases that are combustible.

Coal gasification begins with chemical changes induced in coal simply by heat in the absence of air. The principal product of this “destructive distillation” (pyrolysis) is methane (CH_4), the major constituent of natural gas. Other combustible gases and hydrocarbon products are also produced:

$\text{Coal} \rightarrow \text{CH}_4 + \text{CO} + \text{H}_2 + \text{CO}_2 + \text{H}_2\text{O} + \text{heavy hydrocarbons} + \text{char}$

In contact with oxygen and steam, the hot char (which is a mixture of less-reactive carbon and ash) is the source of additional combustible gas according to three gasification reactions:

$2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$

$\text{C} + \text{H}_2\text{O} \rightarrow \text{CO} + \text{H}_2$

$\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$

The methane (CH_4), carbon

monoxide (CO), and hydrogen (H_2) are the essential combustible constituents of synthetic gas.

The U.S. illuminating gas industry of the 19th century was based on the first (pyrolysis) reaction. More efficient and sophisticated systems which are now in various stages of development and application differ from each other in the means for bringing coal and either air or oxygen into intimate contact and in the methods used to control the elemental carbon-oxygen reactions. The different amounts and grades of gas in the product stream depend on these parameters and on the characteristics of the coal being used. Coal is in fact a complex and highly variable substance.

None of these reactions is shown to involve the sulfur which is a common and troublesome constituent of coal — the source of SO_x in stack gas emissions from conventional coal-burning furnaces. In coal gasification, the sulfur in the coal is chemically reduced to hydrogen sulfide (H_2S) in the first (pyrolysis) stage, and the H_2S is later easily separated from the gas stream. Thus, synthetic gas emerges as a clean-burning fuel. □

not talking about replacing much crude oil consumption by 1985 — perhaps 0.5 to 1 million barrels per day; but it is a start, and a decade later the replacement could be 5 to 10 million barrels. This is a far cry from the visions of Project Independence, but it represents something that could be done and which has a good chance of actually being done.

Research and the Incentives Problem

These predictions are based on a conservative evaluation of what we can expect research to do for us fairly soon to improve the efficiency, versatility, operability, and overall costs of producing synthetic fuels and of burning coal directly. They do not anticipate any spectacular discontinuities; in general, progress in synthetic fuels or direct coal utilization will not be made by great research leaps forward. Instead, we expect to see commercialized a constant succession of important technical improvements on existing procedures. Each such improvement will be tested at increasing scale until it can finally be designed into a working plant the technology of which is otherwise already proven. This is the way petroleum refining was built to its present high state of development, and it is significant that this sort of evolutionary improvement still continues in the technology of petroleum refining.

But despite all the optimistic forecasts implied above, a gap exists between the cost of synthetic fuels produced by any technology we now can envision and the cost of the actual fuels now available to industry. Future crude oil prices are subject to government manipulation, and the calculated price for synthetic fuels is subject to error arising out of incorrect estimates of the efficiency and capacity of plants as well as start-up and operating troubles, to say nothing of an unknown inflation rate for equipment and construction costs. Given all these uncertainties, there is a probable price gap of at least \$1 per million B.t.u.s between the first production of any synthetic fuels project and the projected 1985 price of natural gas and foreign crude oil.

Most commercial-size synthetic fuels projects will cost \$1 billion or more. It is clear that, under these conditions of forecast price differential and technological uncertainty, no capital-intensive synthetic fuels project will be financed in conventional ways under the normal business investment ground rules. Despite this fact, the government has yet to adopt adequate and straightforward means to encourage commercialization of a synthetic fuels in-

dustry based on today's technology. Instead, it has largely opted to subsidize the development of a so-called second-generation technology (which will not be ready by 1985). Yet no second-generation technology will completely replace our first-generation technology, let alone yield a significant increase in efficiency or improvement in economics as a whole. I am convinced that our basic synthetic fuels processes can be gradually improved once they have been commercialized, and that our strategy should be to get on with that process as quickly as possible.

Fuels Beyond 1985

If we assume that this first-generation synthetic fuel technology is in commercial use and that oil and natural gas will be in markedly decreasing supply by 1985, what can be foretold of our situation at that time? Here's a look into one crystal ball.

Industrial fluidized-bed boilers burning low-grade coals will be commonplace after 1985 for many applications requiring up to about 1 million pounds per hour of steam, roughly the requirement of a 100-megawatt electric generating plant. (Such fluidized-bed boilers are not likely to be chosen for large utility installations because of the enormous amounts of limestone and waste to be handled.) The overall cost will be somewhat lower than that of conventional boilers using pulverized coal with SO_x and NO_x controls. These industrial fluid-bed boilers will also accept many kinds of waste to be burned along with coal, either to save fuel or as a convenient waste-disposal system.

Beyond 1985 there should be a rapid increase in the use of industrial fuel gas made from coal as a retrofit fuel for industrial boilers and process heaters originally built to burn natural gas or oil — boilers and furnaces requiring from 20 to perhaps 100 billion B.t.u.s per day. The art by then should be good enough so that plants to produce this fuel could be built for \$8 to \$10 per annual million B.t.u.s (1978 dollars). With coal delivered in the range of \$1.50 to \$1.75 per million B.t.u.s in then-current dollars and 75 per cent overall conversion efficiency, gas cost in then-current dollars could be in the range of \$5 per 1,000 B.t.u.s. This may seem high, but it is to be compared with the cost of scrapping gas-fired boilers and building new coal-fired boilers with SO_x controls and with the cost of petroleum fuels — if then available and allowed for use in boilers.

Assuming that two or three pioneering synthetic natural gas plants are built before 1990, the post-

The Current Politics of "Synfuels"

Philip Shabecoff, a reporter for the New York Times, is currently with its Washington Bureau. He writes on energy, environmental affairs, and other domestic policy issues.

President Carter's call for a "fast track" development of synthetic fuels was, in large measure, a response to a political problem — his own waning prospects for reelection in 1980. Politics, therefore, is likely to determine just how far the "synfuels" program goes.

The ninety-sixth Congress has been notably timid and unproductive, given to darting off in a new direction with every shift of political current like a school of nervous fish. When the gasoline lines started forming early in the summer, Congress feverishly embraced synthetic fuels as an answer to take home to angry constituents. But when the lines disappeared in most of the country, the Congressional will to deal boldly with the energy crisis began to dissolve into the irresolute bickering that has characterized the legislative branch over the past couple of years.

If the synthetic fuels program is to move forward at the pace outlined by the President, it must be launched with the momentum of full national consensus. The technology to carry such a program to fruition exists, the policy makers believe. And there is little argument with the national security rationale for relieving dependence on foreign sources of energy.

Whether that consent is extended probably will depend on whether the public is willing to bear the economic, environmental and social costs involved, once those costs are made clear. It will also depend on whether, and how well, opponents of the massive synfuels program are

able to make their case that there are less expensive, more efficient, and environmentally benign alternatives.

Economic issues are likely to form a particularly difficult political barrier to Mr. Carter's program. For one thing, the cost of developing the synthetics program is going to be high. According to an analysis by the Rand Corporation, the crash program envisioned by the President could easily cost twice the \$88 billion price tag he put on it. The capital absorbed by the program will drain funds that would otherwise be invested in different sectors of the economy. This could very well be a stimulant to continuing inflation as well as a dampener on improved industrial productivity.

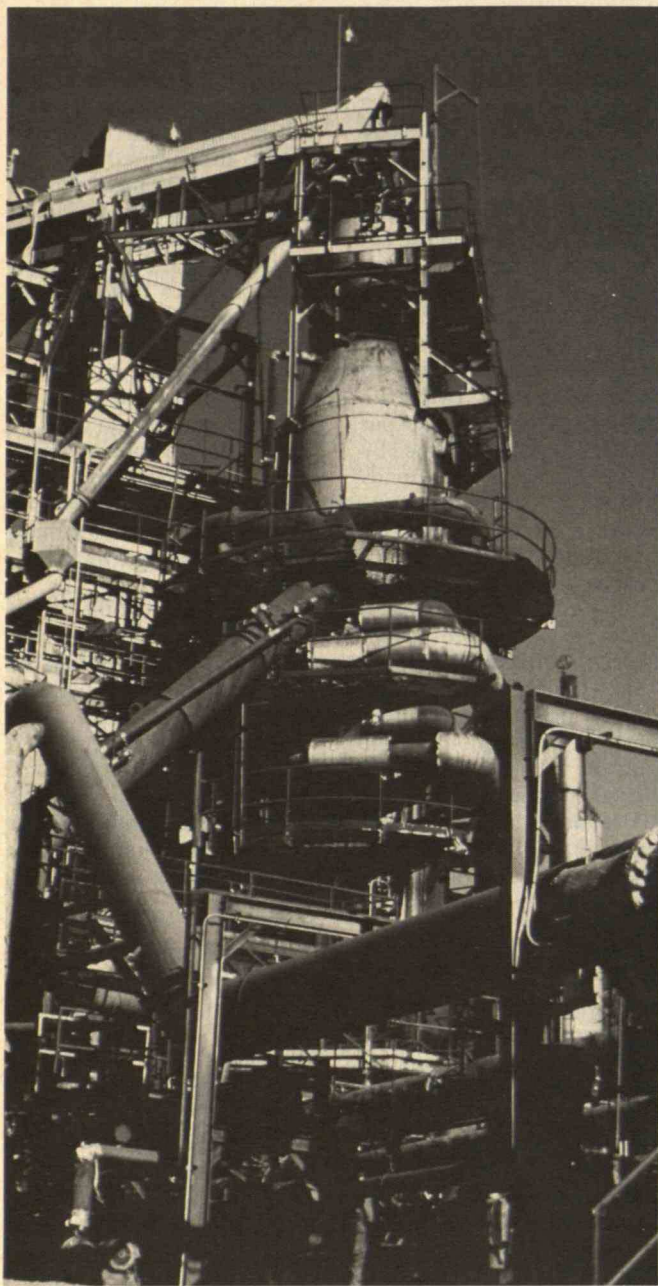
Department of Energy officials insist that while there may not be solutions at the moment to all the environmental problems posed by toxics and carcinogens released during the extraction, processing and consumption of synthetic fuels, technology can provide the answers. More problematical, perhaps, would be resolving priorities in land use and distribution of water resources. On such issues, emotion as well as economics must be weighed in the political balance.

No one has suggested there is a solution at hand for the "greenhouse effect" of carbon dioxide released into the atmosphere during the combustion of hydrocarbons. The problem is often waved aside as something that can be dealt with in the distant future. But a recent study prepared for the Department of Energy suggested that CO₂ could start making a noticeable impact on world climate by the year 2035 (at the current rate of organic fuel consumption). With a massive shift to synthetic fuels, climatic changes could start as early as the end of this cen-

tury, according to Dr. Gordon J. MacDonald, one of the authors of the report.

Environmentalists and others argue that the President's goal of reducing oil imports can be met by more intense conservation along with rapid development of solar energy and exploitation of the nation's large reserves of unconventional natural gas. They argue further that not only would scarce resources and public health be better protected, and costs be lower, but disruptive large-scale additions to the infrastructure, such as pipelines and new communities in rural areas, would not be necessary.

It will be some time before the intrinsic merits of competing energy strategies can be fully weighed. But a political decision will be made soon. The future of synthetic fuels development will probably be determined by how the issue is treated by candidates for office in 1980 — and how the voters respond.



Producing oil from shale. This pilot oil shale retort with a capacity of 200 barrels of shale oil per day (also shown on page 34) is the largest such unit ever built; it was designed and operated by Paraho Development Corp., a consortium of 17 U.S. petroleum companies under a Department of Energy program to exploit the immense oil shale resources of northwestern Colorado. The plant is now shut down following a demonstration production program under which 88,000 barrels of shale oil were prepared for refinery tests. Studies completed in 1976 showed that a commercial plant producing 100,000 barrels of oil per day would have cost \$1.58 billion (1976 dollars). The cost of oil would have been \$11.50 per barrel — or \$17.50 per barrel for a premium quality, low-nitrogen, low-sulfur syncrude. (Photo: Paraho Development Corp.)

1990 period should see serious consideration of some truly commercial plants capable of producing 250 billion B.t.u.s or more of gas daily. This large-scale development of synthetic natural gas will capitalize on the existing pipeline systems for transportation and so will be more economic for many uses than coal, for which rail transportation costs could to rise to prohibitive levels.

Liquid Fuels From Coal

Conversion of coal into methanol, a liquid fuel, should come into its own very soon after 1985 to produce a substitute for oil suitable for premium use in western population centers, including gas turbines to handle peak electric loads in heavy load centers. Imported liquified natural gas could be used, but there are safety problems, and extensive importing would add to our balance of payments problem. The advantage of methanol is that it could be produced in the coal fields of southern Utah and northern New Mexico and transported to the points of consumption by pipelines. Methanol production in Alaska is also promising, with extensive coal deposits near deep water for ocean transport. Unfortunately, the output of a methanol plant using 10,000 tons per day of coal as raw material is equivalent to only 34,000 barrels per day of distillate fuel oil, so early use of large volumes of methanol for base-load generation or other very large demand is unlikely. Should methanol be used as an additive (10 per cent) or a feedstock for gasoline, then giant plants (nearly 60,000 tons of coal per day) would be necessary — and many of them. For example, using methanol as a 10-per-cent additive for current U.S. gasoline consumption would require perhaps seven such plants costing on the order of \$25 billion (1978 basis). In the long run, substituting methanol for gasoline as fuel for high-compression engines is a real and exciting possibility.

The future of liquid synthetic fuels produced from coal through conventional refining is far from clear. My own prediction is that fuel products from shale oil will make such upgrading of coal unnecessary. And long before gasoline will be made from shale oil, it will be made from the petroleum residuals which are now burned as industrial fuel, with coal in one form or another replacing those petroleum residuals as basic fuel.

The research needed after 1985 will be mostly the nonspectacular kind that makes the best return for the money spent — constant improvement of the

same few basic processes: fluid bed combustion, regenerative control of SO_x and NO_x , and processes for producing clean heavy fuel oil, 300-B.t.u. gas, methanol, and methane (synthetic natural gas) from coal.

By 1990, the real bottleneck to synthetic and alternate fuels may well be in the areas of mining and transport, not in the processing or applications technology. Here we will deal with enormous environmental and jurisdictional struggles.

Toward Ultimate Consensus

It is easy to become discouraged and believe that evolving a practical alternate and synthetic fuels program at a useful level is impossible in our political climate. Not so. The operation of a well established, stable, representative democracy is at best nothing more than a consensus process. With terribly complex issues such as energy, it takes an exceedingly long time to work out a consensus. Look at the time already spent merely trying to deregulate natural gas. So far we have only succeeded in agreeing on a new law that will make regulation very much more complicated for another seven or eight years, after which deregulation of some gas can occur with the reservation that regulation can be reimposed if believed necessary!

But we will reach a consensus finally. Crises cause the consensus process to accelerate. After Pearl Harbor we built an entire synthetic rubber industry — raw material production and all — in about four years, and it worked. It still does — and accounts for 75 per cent of our rubber use. We started on synthetic rubber in 1940 with far less technology in hand than we had on synthetic fuels in 1973-74, when the latest push toward synthetic and alternate fuels began.

Will the present pressure for synthetic and alternate fuels die away if we have somewhat more success with oil and gas than expected (we have always underestimated the availability of these two ubiquitous fossil fuels), and if energy growth rates moderate a bit? The answer is clear: nothing can prevent increasing future demand for synthetic and alternate fuels. We are already in fact dependent on imports for roughly half of our petroleum and a quarter of our total energy; the public has been sensitized as never before to the role of energy in modern society, and the pressure for assured supplies is very high; we have already overbuilt our coal mining industry compared to its market, and

that coal has got to go somewhere; our technology for synthetic fuels is rapidly approaching a full base from which to launch massive energy production; and there are no magic answers just around the corner such as solar energy, methane from cow manure, little bugs who will ferment us out of trouble.

We have only the harsh reality of needing now a very capital-intensive industry that can convert high-energy-content materials such as coal and oil shale into useable forms of energy. For large-scale energy uses, the low-energy-intensity sources such as solar require even more technology and very much more capital. They will come later.

This fact has not sunk in well yet, but it will, when the various well-intentioned but uninformed pressure groups discover the difference between heating a few gallons of water for bathing and dishwashing and melting 1,000 tons of steel.

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New Challenges to Management in the Synfuels Revolution

by Ben C. Ball

The idea that the petroleum industry, with capital investments in the hundreds of billion of dollars, may largely replace itself in less than a generation to produce synthetic fuels instead of processing natural crudes is unprecedented. Many industries in the past have been replaced by marketplace processes of "natural selection." But today, in the case of the petroleum industry, we are talking instead of what amounts to reconstruction on a massive scale — and in a basic and crucial area.

This demand for rapid, massive change comes as the consequence of events which have already led to dramatic shifts in the "traditional" petroleum business. During the period when U.S. petroleum reserves were expanding at least as rapidly as demand, the cost of petroleum was attributable largely to the risk caused by low success ratios in exploration. Now, however, the geology of the U.S. is comparatively well known and traditional "wildcat" exploration is no longer a major cost center. It has been largely replaced by the vast sums which are required to lease and develop tracts, as in the case of deep offshore wells.

Now, with synfuels under consideration, this shift from exploratory risks to front-end development and production outlays seems destined to continue. In addition, synfuel development implies a shifting emphasis from profits derived from successful exploration to profits derived from success in processing.

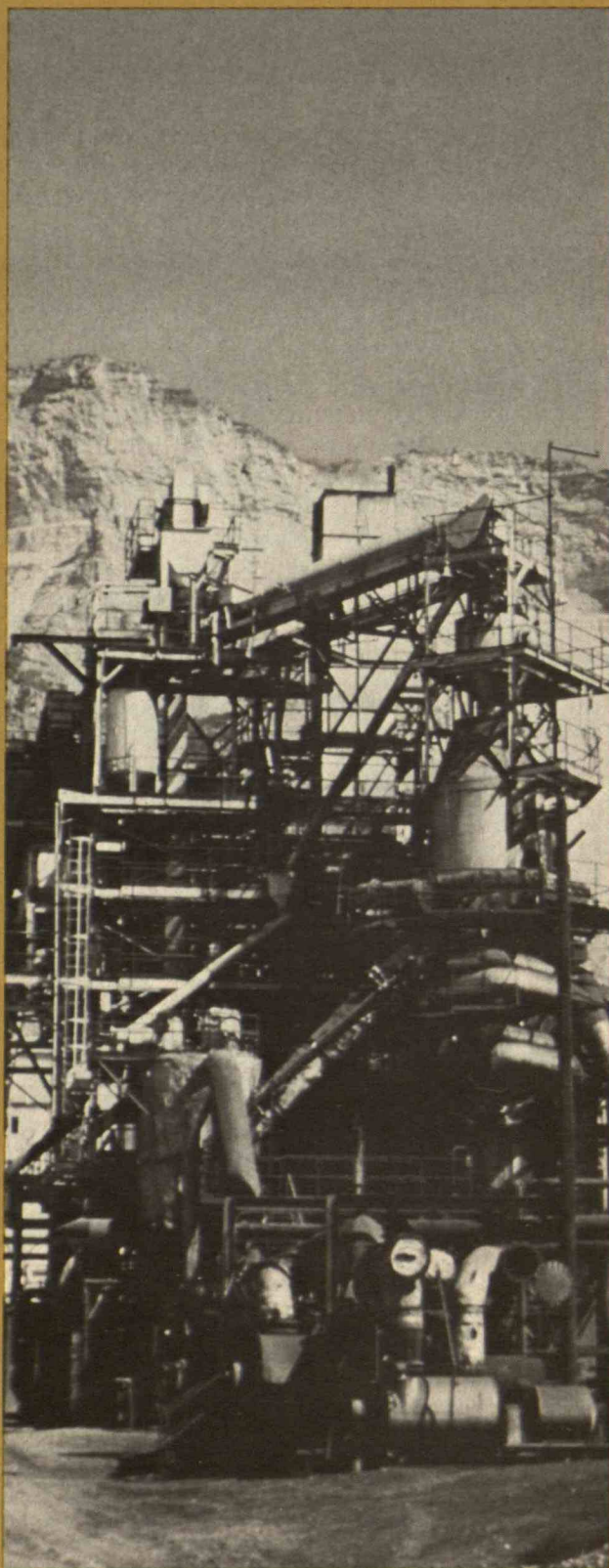
Another important change will be in the role of technology. Historically, the two technological changes which had the greatest impact on the petroleum industry came from outside the industry. The first change was really two changes: as electricity replaced kerosene for light, the development of the oil burner opened a whole new market for oil as heating fuel. The second change was the automobile, which offered petroleum its other major market. Technological change within the petroleum industry itself has been largely evolutionary.

The prospect of synfuels brings with it the prospect of a rapid, massive infusion of a new technology, driven not by evolutionary changes in product demand or by profitability but by traumatic changes in raw material supply. And if this were not change enough, there is prospect of increasing the "guidance" of government.

Changing Stakes for Entrepreneurial Success

Not only are the internal dynamics of the industry undergoing major shifts; the real-world environment to which current and future decisions must relate is also shifting. The present industry is composed largely of firms selected by marketplace dynamics. In general, corporate failures in this industry have been small. Two crucial differences arise with synfuels: the decisive factor in success or failure will be technology, and corporate failures — if and when they occur — will be enormous by any standards. The failure of a single synfuel plant producing 50,000 barrels per day would be equivalent in size to the bankruptcy of the 100th largest U.S. corporation.

The private sector has grown in the past largely by mastering the art and science of matching risk to return, with the risks covered in addition by corporate resources not at risk. The stakes in decisions surrounding synfuels over the next



decade or so will be much higher; they will be "you-bet-your-company"-type decisions — and here we're talking about the largest companies in the world. I do not mean to say that learning by trial-and-error with these kind of stakes is impossible. But it is certainly unprecedented in the private sector, and it would be naive at best to believe that new frameworks are not required. The odds when we roll a die for a quarter may be the same as those in Russian roulette; but the latter is a whole new game because the stakes are so much higher.

The time frame is also new. For conventional major capital investments to be attractive, they must be viable for a quarter century or more. This requirement presents no exotic problems in mature industries with well defined technologies and where competitive forces are perceived to be well known. However, the familiar tools for evaluating investment decisions over long time spans become little more than academic exercises in a totally undefined industry such as synfuels. We have no tested tools for *deciding* today the viability of a huge new industry over a long time frame.

Our free-enterprise system has become accustomed to including growth as a significant criterion of success. The entire energy sector may continue to grow through all of the next century; but it is much harder to assure the growth of any particular technology in an era of rapid technological change. Similarly, competition is always a risk; but here, where the structure of the industry will not be known for decades, we do not know what the competition will be. What will happen to synfuel demand, for example, if breeder or fusion technology become successful factors in energy production? What is the basic attraction in exploiting a technology whose death certificate is already being filled out as rapidly as possible in the finest research and development laboratories in the world?

Indeed, we are even uncertain about which parameters contain the significant risks. For example, future price has always been an uncertainty; but in this case we are not even certain which forces will determine prices. Will the prime competition be O.P.E.C., with a cost base different from ours by one or two orders of magnitude and with significant non-economic criteria? Will public policy set prices (and volumes), with profitability determined arbitrarily?

Even if, somehow, we could be told now what the actual price will be in the future, removing all risk and uncertainty from that dimension, we would still be very limited in making decisions for lack of understanding of the dynamics of how that price was determined. A price determined by the incremental cost of conventional petroleum is qualitatively very different from the same price determined by, say, an international cartel or by public policy.

In short, a business cannot be defined without also defining the structure and dynamics of the industry of which it is a part. Uncertainty about one increases the uncertainty about the other by an order of magnitude.

Two pivotal fine points — easily missed — should also be considered here:

□ Incorporation in the United States implies the right to existence as long as profits are satisfactory in the eyes of the corporate investors and as long as the generalized rules of the game are obeyed. A company's decision to devote itself to shoes, or energy, or machine tools is its own decision, not

one forced upon it. The shoe and energy companies are by no means obligated to fill shortages of shoes or energy if and when they exist; the companies' purpose is rather to maximize profit after considering all factors. If there are no profit opportunities in its traditional product, there is no obligation for any company to furnish plentiful, low-priced supplies of it.

□ The United States government was designed not so much to cooperate with the private sector as to regulate it and to deal with its crises on a short-term basis. We have neither the cultural framework nor the practical means for the government to guide the private sector towards predetermined goals over a long time span. In this sense one must wonder what a "national energy policy" could be and just how the government would go about effecting it.

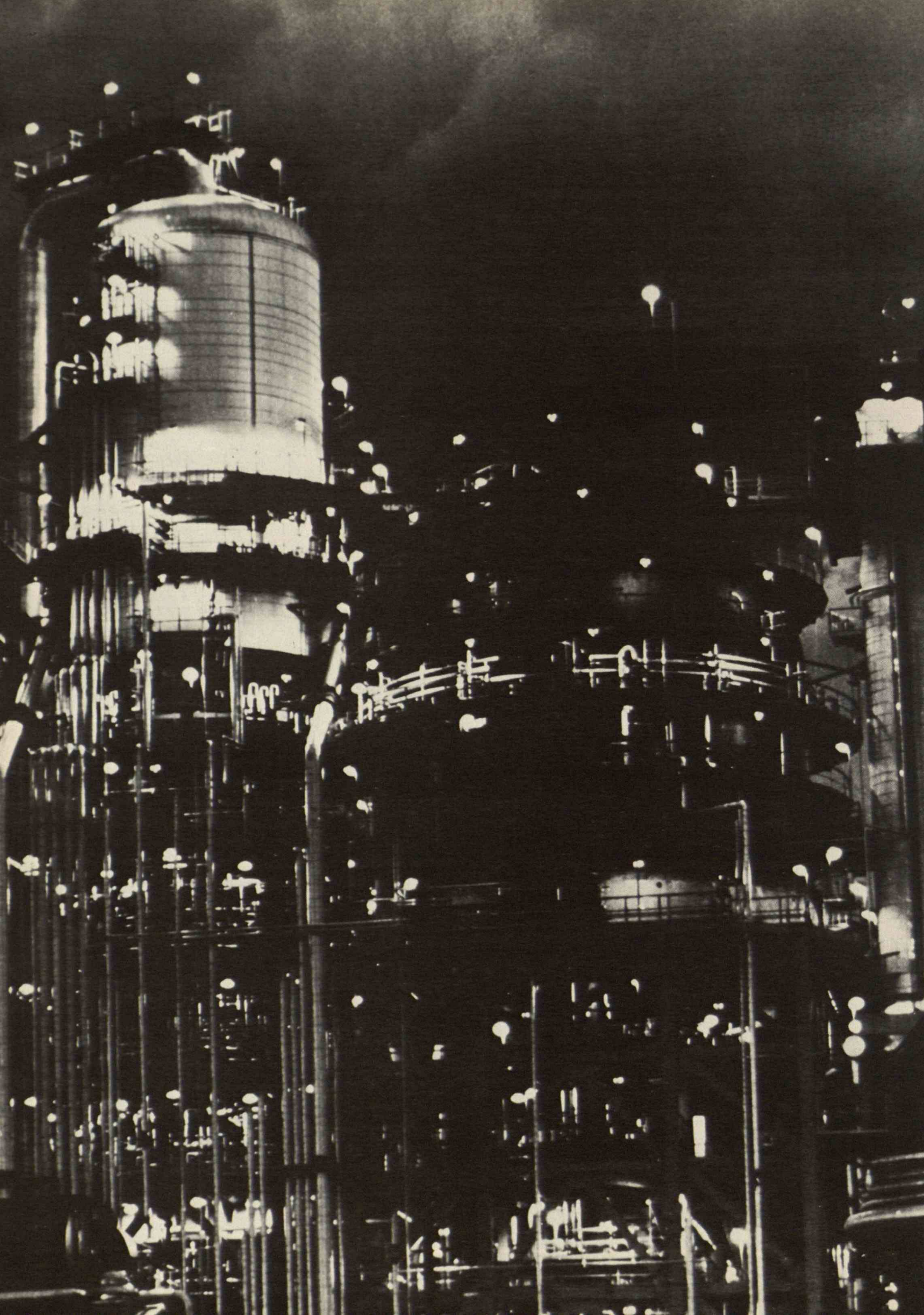
The Trauma of the Truly New

These differences and uncertainties are not in themselves "good" or "bad." My point is only that they will change many of the criteria and models for management decision-making, representing in many respects an "identity crisis" for the energy industry: What will it mean to be an "energy company?" Will we be investors, explorers, operators, or sellers of services? How is diversification of risk to be accomplished, especially when a synfuel plant costs more than the resources of all but a few companies in the world? How will you sell services? How much will you charge per hour for the services of the man who discovers the next large field of inexpensive oil?

All these issues come together in the need for a new approach to decision-making process in the energy sector. In this sense, it is entirely possible that the most significant breakthrough to occur during the rest of this century in dealing with the energy issue will be the development of a new and adequate decision-making process which can be used authentically by both the public and private sectors to deal with real issues in a significant way.

The greatest danger today is to believe that the new kinds of decisions facing us are not really new, but are merely different from those of the recent past in degree or magnitude and will therefore respond to traditional skills and methods. My argument here is that our problems are truly new. We have some ideas about the ways in which they are new, and there is a lot of promise in the current struggle to develop the management styles for handling them adequately. But it would be disastrous to underestimate the trauma possible before the new industrial structure and culture have been hammered out. — Ben C. Ball, Jr. □

This short article is adapted from a paper prepared by Professor Ben C. Ball for a Workshop in Energy Supply and Demand at the International Energy Agency of the O.E.C.D. in Paris in 1978. The author is adjunct professor of management and engineering at M.I.T. and a senior member of the staff of the M.I.T. Energy Laboratory. A graduate of M.I.T. (chemical engineering), he was with Gulf Oil Corp. (most recently as vice president in the Corporate Planning Group) for 30 years before returning to Cambridge in 1978.



Water For a Synthetic Fuels Industry

by Ronald F. Probstein

The present struggle to cope with America's energy problem has been described by Alvin Weinberg, former director of Oak Ridge National Laboratory, as an energy war whose conduct resembles a "religious war" in which no quarter is asked or given. Those who see an energy future based primarily on the Sun (usually astride white horses) are pitted against those who are fighting for an energy system based on uranium breeders (they are almost always dressed in black and ride black steeds).

Unfortunately, as in all religious wars, there are the non-combatants who are usually impaled by both sides. In this instance the non-combatants are those who visualize an intermediate term energy system based in part on the production of synthetic fuels compatible with society's existing technology. Such a system would be of limited duration, until the solar or nuclear power options could be properly harnessed.

But the combatants will have none of this. Fossil fuels are described by both sides as limited in extent (only about 200 to 400 years) and beset with the uncertain effect of carbon dioxide release into the atmosphere (another 100 year problem). Failing to dispose of the synthetic fuel option on an intermediate term basis, the immediate is selected. A typ-

ical quote from a recent article in *Technology Review* on fuel conservation, that may be considered representative of the thinking of both sides, is "Synthetic fuels can contribute little to overall supply by 1985, and there may be factors such as water availability which absolutely limit their development."

The religious war goes on unabated, but the one crucial issue on which both sides seem to agree is that synthetic fuel development will be constrained because of a lack of water. This is an incorrect conclusion based on a misunderstanding not only of the chemistry and technology of synthetic fuel conversion, but also of the chemistry and technology of water treatment and the cooling of thermal systems. In fact what will be shown is that from the criterion of water availability alone, a relatively high level of synthetic fuel production is supportable in the principal coal-bearing regions of the United States. The same can be said of the production of oil from shale, although I will only consider coal conversion here.

In the United States, the importance of water usage in synthetic fuel production lies principally in the fact that much of the easily mined coal is to be found in the arid western areas of the country. The nation's richest "hydrocarbon basin" cuts a swath from Montana in the north to New Mexico in the south, with its center underlaying the upper Colorado River Basin. In these arid and sometimes drought-ridden areas, agricultural, industrial,

Left: One of two cokers used to upgrade crude bitumen separated from the vast deposits of oil sands in northern Alberta, Canada. This plant is designed to produce 125,000 barrels of synthetic crude oil a day. (Photo: Syncrude Canada, Ltd.)

municipal, recreational, and power needs compete for a limited water supply. However, the problem of water shortage is not limited to the West. In the humid coal areas of Illinois and Appalachia in the East, local and temporary water shortages could impede the development of synthetic fuel facilities at some coal mining sites. In all regions, the discharge of water is constrained by the environmental limitation that the plant effluent waters may not add pollutants to the surface or ground water.

Consumptive Uses of Water

In a synthetic fuel plant the four major consumptive uses of water are for hydrogen, cooling, waste disposal, and environmental control.

The first of these arises because the manufacture of synthetic fuels from coal is essentially a hydrogenation process in which water is the source of the hydrogen. The amount of water consumed depends on the difference between the hydrogen-to-carbon ratio in the coal to this same ratio in the product fuel (plus any byproducts). A typical bituminous coal by weight contains 75 per cent carbon, 5 per cent hydrogen and 20 per cent inert or undesirable matter. Its carbon-to-hydrogen weight ratio is about 15. The coal can therefore be characterized by the molar formula $\text{CH}_{0.8}$, since the atomic weight of carbon is 12 and that of hydrogen is 1. On the other hand natural gas, for example, which is almost entirely methane (CH_4) contains 75 per cent carbon and 25 per cent hydrogen. Its carbon-to-hydrogen weight ratio is three. If methane is the end product of the synthesis, then the theoretical minimum amount of water to supply the hydrogen over and above that in the coal is about 9 gallons per million B.t.u. of heating value in the methane. There is a little over 2 million gallons per day for a plant manufacturing 250 million cubic feet per day of synthetic natural gas, which is considered the nominal size for a "standard" plant. In the manufacture of synthetic crude oil and refined coal the minimum theoretical water requirement may be a fifth or less of that to manufacture natural gas, because of the need for less hydrogen. For example, the carbon-to-hydrogen weight ratio for crude oil is about nine so that its molar formula would be $\text{CH}_{1.33}$. The less hydrogen that is added to the coal, the lower is the boiling point of the synthesized hydrocarbon.

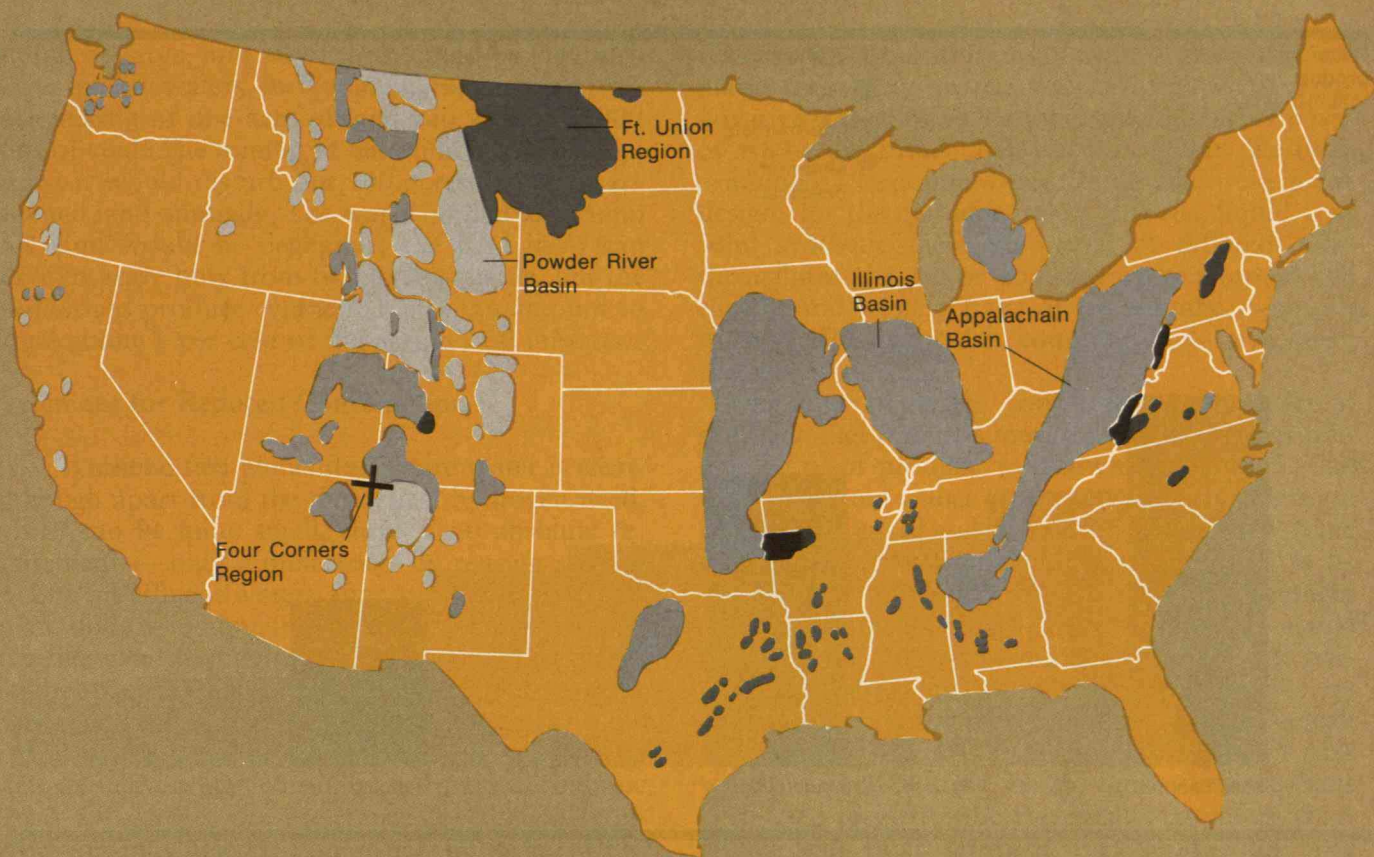
As in any real process, no conversion can ever be completely efficient. The available energy or heating value of the coal cannot be fully recovered in the

synthetic fuel. This unrecovered thermal energy must be transferred to the environment in some way. Normally, part of the unrecovered heat is disposed of by evaporating water, and this consumptive use is most often the prime determinant of total water consumption in the plant. The quantity consumed in cooling depends principally upon the overall plant conversion efficiency, which is generally higher the less hydrogen that must be added to the coal to obtain the product fuel. Refining coal may be accomplished with an energy conversion efficiency of 75 to 80 per cent, while gasifying it may be carried out at only a 65 to 70 per cent efficiency.

It is important to recognize that not all the unrecovered heat must be dissipated by cooling. Even if this were desirable it would not be possible, since an appreciable fraction of this heat will be lost directly to the atmosphere up flue gas stacks, in heat radiated from boilers, and from other sources over which one has little or no control. Disposing of all the remaining unrecovered heat by evaporating water is generally not economical; some of the heat should be transferred to the atmosphere by forced air cooling. But even in a wet evaporative cooling tower the air will also carry away heat, so that although 1,000 B.t.u.s will evaporate a pound of water, the actual amount of heat carried away is closer to 1,400 B.t.u.s for every pound of water evaporated. The extent to which water is evaporated to remove the unrecovered heat that must be dissipated by cooling, in a properly engineered design, should depend upon whether the plant is located in a region where water is plentiful or scarce, coupled with the true cost of water. As a reference, expensive water is that costing more than \$1.50 per 1,000 gallons.

In water-rich areas, typically only 25 to 60 per cent of the total unrecovered heat should be dissipated by evaporating water, while in arid regions or where water is expensive no more than 10 to 30 per cent of the unrecovered heat should go to evaporate water.

Water is also required for the mining and preparation of the coal and for ash disposal. The quantity is a function of location, principally through the coal heating value and ash content, which affects the amount of coal that must be mined and the amount of ash that must be disposed. Sulfur removal also consumes water, and the amount depends not only on the fraction in the coal but also on the conversion process. Water is also needed for a number of other purposes that depend upon climate, such as land reclamation. However, none of these requirements



Medium- and high-volatile bituminous

Anthracite and semianthracite

Subbituminous

Low-volatile bituminous

Lignite

0 500 Miles



Coal fields of the United States. Much of the easily mined coal is found in the west of the country, where scarce water must be divided among agricultural, industrial, municipal, and recreational needs.

Water consumed/
product heating value
(gal./10⁶ BTU)

40

30

20

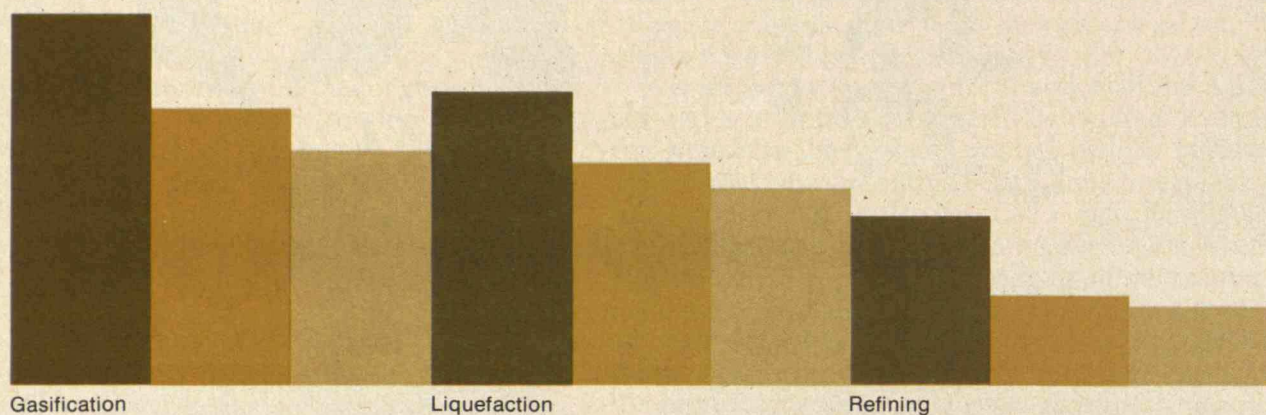
10

Wet cooling

High

Intermediate

Minimum
practical



Consumption of
available
surface water (per cent)

100

10

1

0.1

0.01

Number of standard size plants

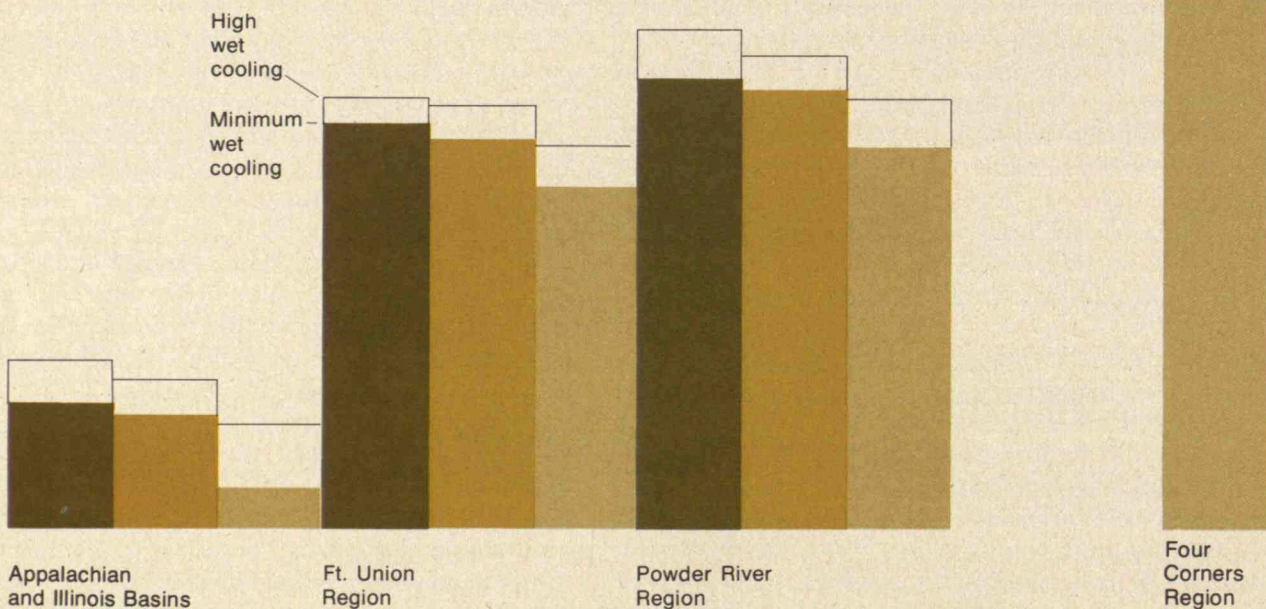
Gasification (24)

Liquefaction (19)

Refining (18)

High
wet
cooling

Minimum
wet
cooling



should be large, and all of them could be met with lower quality waters. In Wyoming, for example, surface mining of one acre of land can yield 100,000 tons of coal. The mining of ten million tons of coal per year would disturb but 100 acres of readily reclaimed land annually. The water needed to reclaim this land would be negligible, the land itself can serve to graze only from two to four cattle, but the coal would produce synthetic fuel in an amount to equal about 1 per cent of the nation's oil imports.

Preference for Reduced Consumption

That synthetic fuel plants do require water is clear, although apart from the theoretical hydrogen need, which can be quite small, there is no absolute requirement — only a preference. By reusing and recycling all effluent waters after any necessary treatment, and by minimizing water consumed for cooling, the water requirements for synthetic fuel plants can be reduced to low levels. The preference is principally an economic one that largely depends on the site as it affects the real cost of water. But, as will be seen, reduced water consumption makes economic sense. Of course, the preference for reduced consumption may also rest on social, political, or environmental grounds.

My colleagues and I have applied our knowledge of water chemistry in synthetic fuel plants to enable the application of modern water conservation and reuse strategies in cooling, in the fuel production process, in solids disposal, and in mining. The pertinent strategies include, among others, the use of combined air and evaporative cooling, the extrac-

tion of high concentrations of toxic organic contaminants from dirty process waters by a variety of innovative technologies, and the removal and disposal of ash by dry rather than wet procedures. We have examined a large number of integrated mine-plant designs for the manufacture of gaseous, liquid, and solid synthetic fuels from coal at different sites throughout the major coal-bearing regions in the eastern and western parts of the country. Approximately 100 plant-site combinations have been studied.

Estimates of water consumption for different synthetic fuel products measured in gallons per million B.t.u. of product are shown on page 42. The Probstein-Gold values assume all effluent waters are recycled or reused and that none is discharged. (One never pays to treat water for discharge back to its source.) The ranges shown are based on averages among various plants and sites. Although actual values would depend to some extent upon the particular processes and sites chosen, recent, more extensive calculations show the amounts to be typical.

Also included are data from two recent and widely quoted sources which, among others, have been used to justify the argument that water availability will limit synthetic fuel production. The upper end of these estimates, which cover an unnecessarily and unrealistically wide range, are excessive by an order of magnitude. For a coal gasification plant designed uneconomically so as to be extremely wasteful of water, the total net water consumption might approach but would not exceed 100 gallons per million B.t.u. This is based on a conversion efficiency of 65 per cent, with all of the unrecovered heat dissipated by wet cooling (a condition which is itself not realistic) and with all the dirty process water disposed of by evaporation and none recycled in the cooling system. To approximate a figure of 100 gallons per million B.t.u. for a plant producing 50,000 barrels per day of oil or other fuels with an equivalent heating value would mean a consumption of 31 million gallons per day of water, or about 15 barrels of water per barrel of oil.

The ranges in our calculated values of water consumption result primarily from the degree of wet cooling assumed to be used in disposing of the unrecovered heat. The difference in average overall plant water consumption with different degrees of wet cooling can be seen on page 40. If forced air coolers are used *only* when these are clearly cheaper than evaporative wet cooling, the largest single consumptive use of water in any plant is for cooling,

Water consumption in the production of synthetic fuel from coal is shown to depend on the degree of wet cooling which is used to dispose of unrecovered heat. High wet cooling describes the minimal use of forced air coolers. Intermediate and minimum wet cooling denote the use of evaporative cooling towers in combination with forced dry air cooling, which can reduce the cooling water consumption by one-half to two-thirds.

Water consumption to produce from coal a million barrels per day of synthetic crude (or its energy equivalent) in each of five major U.S. coal regions. (Figures are combined for the Appalachian and Illinois basins.) Consumption is shown as a percentage of available surface water, meaning water available at the surface after allocations for industrial, agricultural, municipal, and other uses. Moreover, consumption is given for each of three technologies — gasification, liquefaction, and refining. Thus, to give one example, coal gasification, requiring 24 standard-sized plants to produce the energy equivalent of one million barrels per day, would consume in the Ft. Union region less than 5 per cent of available surface water if minimum wet cooling is employed.

| | Harte El-Gasseir (<i>Science</i> , 1978) | Alternate fuel demonstration program (ERDA, 1977) | Probstein Gold (M.I.T. Press, 1978) |
|--------------|---|--|--|
| Gasification | 25-173 | 27-126 | 16-24 |
| Liquefaction | 25-221 | 44-114 | 13-19 |
| Refining | — | 14-22 | 7-13 |

Estimates for water consumption in gallons to produce a million B.t.u.s of heating value from liquid, gaseous, and solid synthetic fuels. The Probstein-Gold estimates assume that all effluent waters are recycled or reused and that none are discharged. The other two sets of estimates cover a range that is unrealistically wide according to the author; their upper ends are excessive by an order of magnitude.

| | Water treatment | Use of minimum wet cooling |
|--------------|--------------------|----------------------------------|
| Gasification | 5.4-14.0 | 1.3 |
| Lurgi | 1.7-4.3 | 1.4 |
| Synthane | | |
| Liquefaction | 0.3-1.1 | 1.2 |
| Synthoil | | |
| Refining | 0.7-1.6 | — |
| SRC | | |

Estimated water treatment costs for complete recycle and reuse. Figures are given in cents per million B.t.u. in heating value of product fuel for different conversion processes. The rightmost column of the table shows the cost of having changed to a system using the minimal practical degree of cooling with water, with forced air cooling substituted where the use of water is foregone. It is, in short, a replacement cost for water.

generally amounting to between 50 and 75 per cent of overall consumption. This corresponds to a range of between 7 and 15 gallons per million B.t.u. of product fuel, or 2 to 4 million gallons per day for standard-size plants.

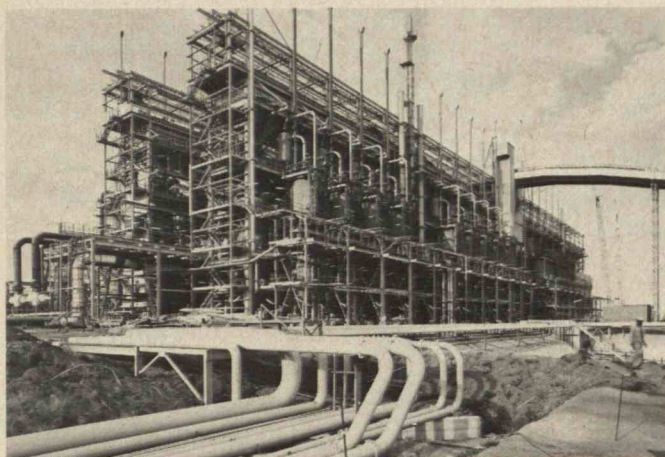
Our estimated water treatment costs for complete recycle and reuse are shown in the table below. These costs do not include any charges for obtaining water, but in any case total treatment costs including water charges would not exceed 5 per cent of any reasonably estimated production cost. It can be seen that the rather large water savings accompanying combined cooling systems can be carried out at a cost not likely to exceed 0.5 per cent of the price of producing the synthetic fuel.

Water Availabilities for a Significant Industry

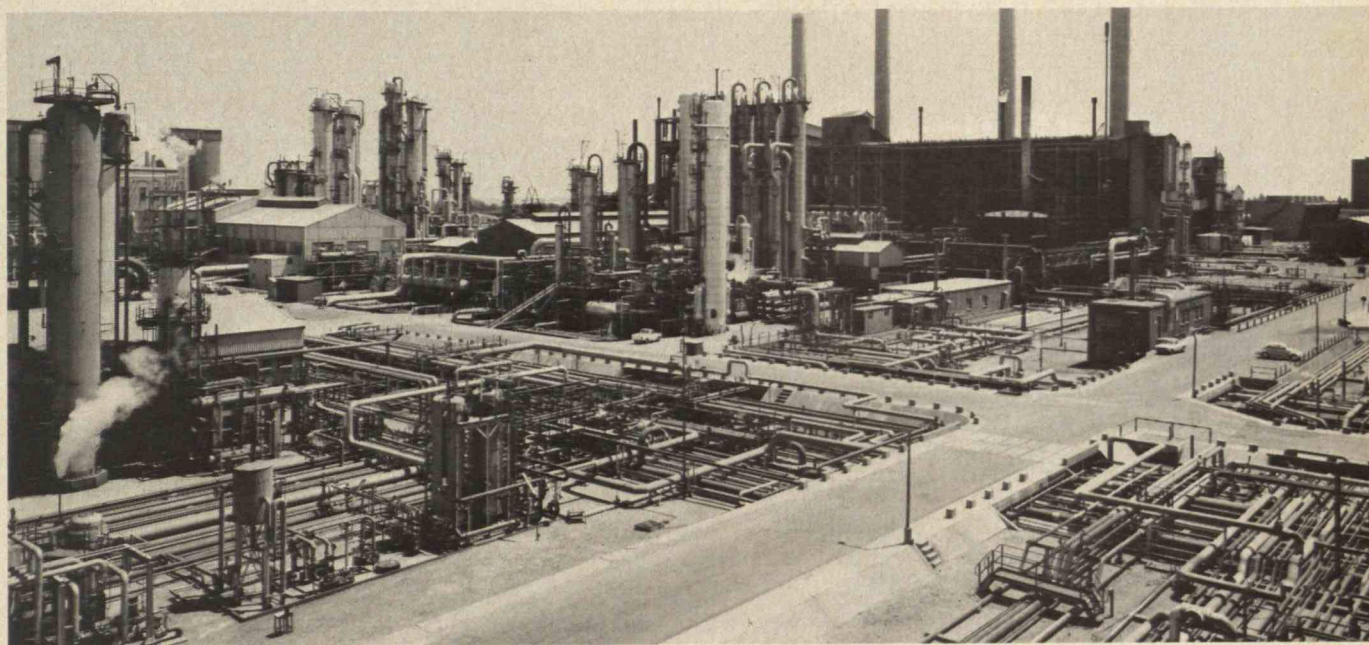
A representative level of synthetic fuel development would be an industry producing one million barrels per day of synthetic crude or its equivalent of about 6 trillion B.t.u. per day in other fuels, in each of the five principal coal-bearing regions of the United States. This corresponds to a total production of 5 million barrels per day of synthetic crude or its equivalent in other fuels, which is about the rate at which crude oil is now being imported. (An additional 2 million barrels per day of finished products are also imported.) A production of one million barrels per day of synthetic crude or its equivalent in heating value would require about 20 standard-size plants. The percentage of the average annual values of available *surface water* consumed in each region by this level of synthetic fuel development is shown in the chart on page 40. Estimates of surface water availability have been made on the basis of supply and demand requirements including water used or allocated for agricultural, industrial, and municipal uses as well as other forms of energy development.

In the relatively arid Powder River and Fort Union regions of Wyoming, Montana, and North Dakota the highest consumption would be no more than 14 per cent of available surface water, and consumption could be as little as 1.5 per cent. While the surface waters of the Four Corners region would be unable to support the million barrel per day or equivalent production level requirements for liquefaction or gasification, a high level of refining would be possible.

From the criterion of water availability alone, these figures show that except for the most arid areas and those areas where water is already largely



The SASOL coal liquefaction plant (below) produces about 9,000 barrels per day of motor fuels — mainly Diesel and gasoline. It has proved a successful test of the low grade coal found along the Vaal River in South Africa since it was completed in 1955. The coal gasification section (left) of the SASOL II plant in the coal rich region of eastern Transvaal. Production of 50,000 barrels per day of liquid fuels will begin at the end of this year; 100,000 barrels per day are expected in 1982. (Photos: Lurgi Kohle und Mineralöltechnik GmbH)



allocated, a relatively high level of synthetic fuel production can be supported in the principal coal regions of the United States. However, the plants require years to set up and much remains to be learned in developing a full scale synthetic fuels industry. If we are all not to find ourselves riding either black horses or white horses in the place of automobiles, it is essential that the construction of synthetic fuel plants begin now.

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Ronald F. Probst is professor in the Department of Mechanical Engineering at M.I.T. His article is based on a talk delivered to the 1978 Annual Meeting of the National Academy of Engineering. Most of the data in the article have been drawn from his recent book with Harris Gold, *Water in Synthetic Fuel Production* (1978) published by the M.I.T. Press, Cambridge, Mass. Professor Probst came to M.I.T. in 1962 after having served on the faculties of Brown and Princeton Universities. About 1966 he "reconverted" his research and teaching activities from problems of missile reentry to the areas of water purification and desalination. Since that time he has directed the activities of the M.I.T. Fluid Mechanics Laboratory in these areas. In 1974 he formed the consulting firm of Water Purification Associates primarily to provide engineering advice on water needs and treatments for synthetic fuel conversion processes and steam-electric power generation.



by
Mary Rawitscher
and Jean Mayer

If the nation's
population
of 220 million
were to substitute
a pound of perch or
sardines for a pound of beef or
shrimp once a month for one year,
the energy savings would be equivalent
to 144 to 177 trillion kilocalories or 99
to 117 million barrels of oil.

Design, production and flight of the *Chrysalis*, M.I.T. students' human powered airplane **A2**
Reunions: reminiscences, gifts, and a belly dancer **A8**

Technology Day lectures, discussions, debates **A11**

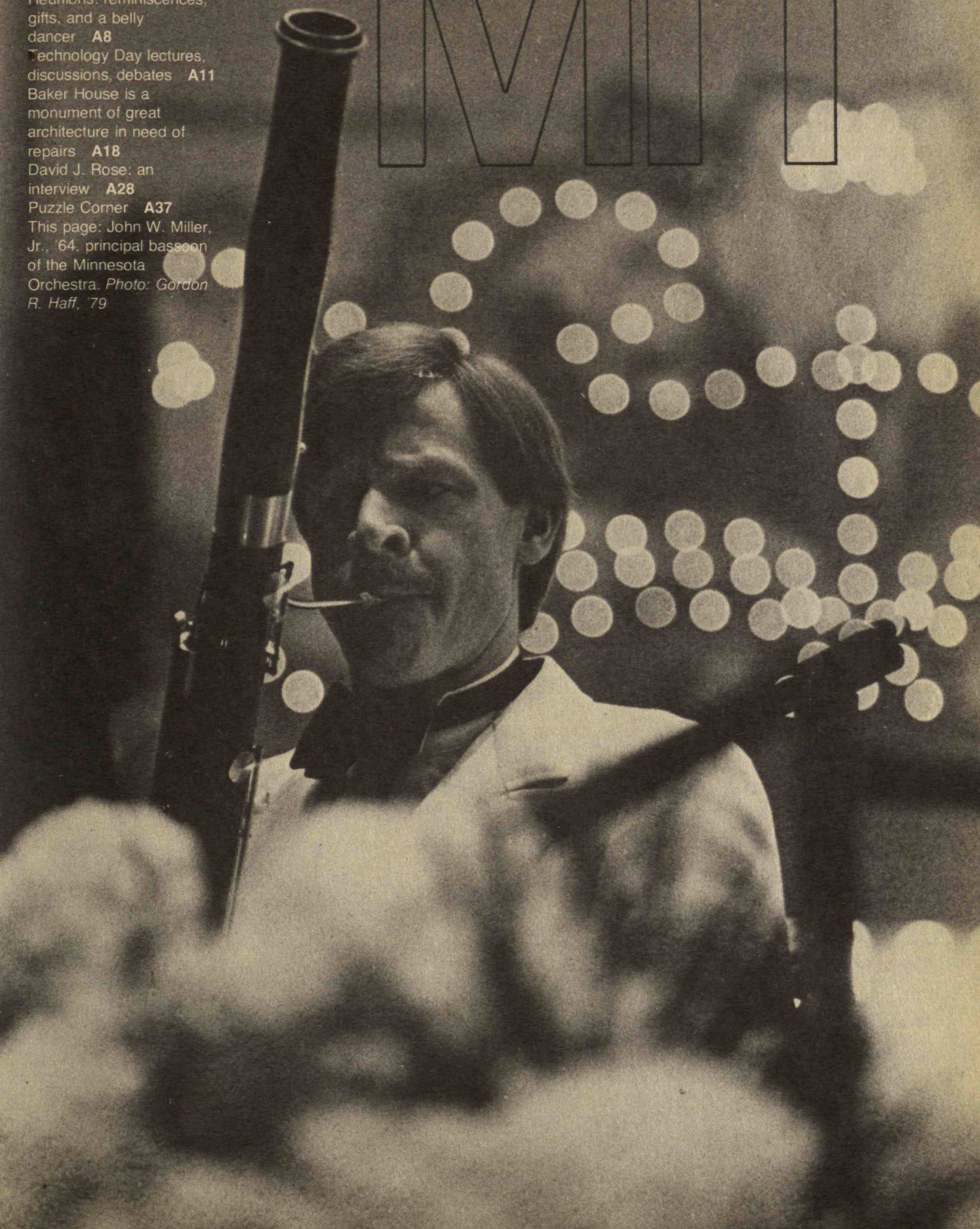
Baker House is a monument of great architecture in need of repairs **A18**

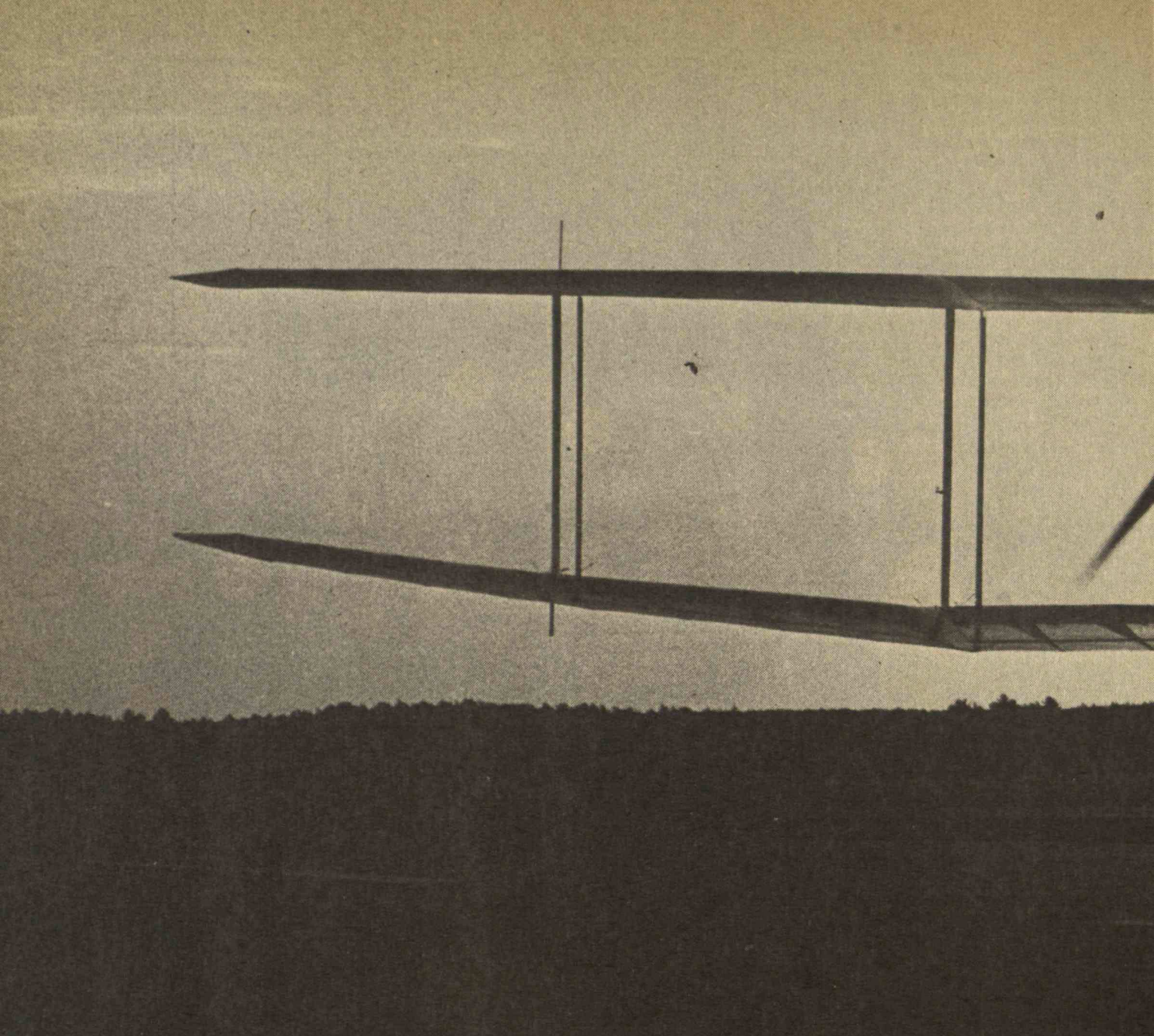
David J. Rose: an interview **A28**

Puzzle Corner **A37**

This page: John W. Miller, Jr., '64, principal bassoon of the Minnesota Orchestra. Photo: Gordon R. Haff, '79

MIT





"Don't step on the bottom of the cockpit — your feet will go right through. Strap your feet in very tightly. Do everything smoothly. Pedal gently at first and when we say POWER! give it all you've got. If your wings bank to the left, pull the stick to the right. That is important. What do you do if the left wing tilts downward?"

"Pull the stick to the right."

"Yes. Your pedal speed determines altitude only; the stick motion determines speed. Don't think about it, just do it."

Guppy Youngren, '79, is intently explaining the mechanics of the *Chrysalis* human-powered airplane to me as I prepare to be its pilot and engine.

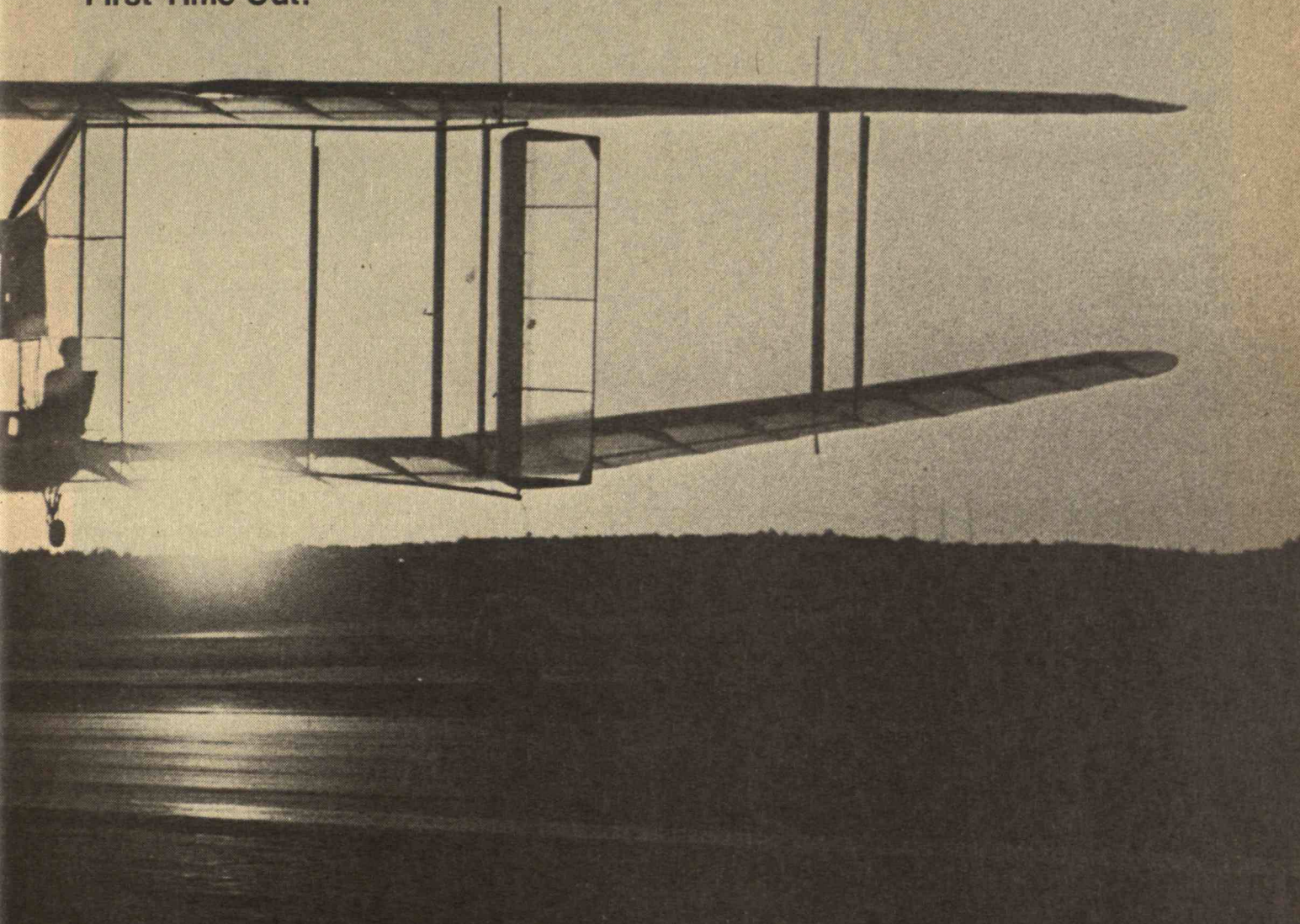
It was his and a few other enterprising M.I.T. students' baby, it cost them and about 20 intermittent participants 3500 hours of work, and it flew the first time out. Now it was a matter of refining the details, going for longer flights, experimenting with turns.

They took a lightning approach from design to production: 91 days between the first construction and roll-out day, weeks where the hard core (Bob Parks, '79, Harold "Guppy" Youngren, '79, John Langford, '79, Hyong Bang, '79, and Mark Drela, '82) sometimes averaged 60 to 80 hours of work. Their experience on model airplanes (the three competed in Bulgaria last fall for a model rocket

competition world championship and Youngren won) was of great value — it was the two radio-controlled scale models they built first that took the test beatings, flying in the du Pont gym (to the dismay of basketball players). The huge and graceful *Chrysalis* was built *after* most problems were recognized.

The history of man-powered flight at M.I.T. is not glorious. A total of nine years, three generations of students and 20,000 man-hours produced two airplanes. Neither got off the ground. In December, BURD (Biplane Ultralight Research Device) was scheduled to be trashed because of lack of hangar space — and waning enthusiasm — after the

Chrysalis, Human-Powered Airplane: It Flew the First Time Out!



winning of the coveted Kramer Prize for man-powered flight by the *Gossamer Condor*, built by a California group led by Dr. Paul MacCready.

On a whim, Bob Parks and Guppy Youngren (model airplane addicts) asked permission to give it a try with model airplane engines replacing the second pilot (BURD was built for two). It didn't work.

It was an undignified end to an intricate design. But it was the beginning of a fascination with the problem, quickly escalating into total involvement, for Youngren, Parks, and Langford that resulted in a completely new effort.

In the beginning they could be found, binoculars in hand, on the

ground floor of the Smithsonian in Washington inspecting the *Gossamer Condor*. But first priority: make something of their own. "We called ourselves the 'Chrysalis Group,'" says Aero-Astro Professor Eugene Larrabee, their advisor, "with the thought that whatever came out of our effort would grow into something else."

Bob started working on the design over Christmas vacation, Guppy joined in when he came back, and by the first or second week in January they had a design that was almost recognizable as the finished plane.

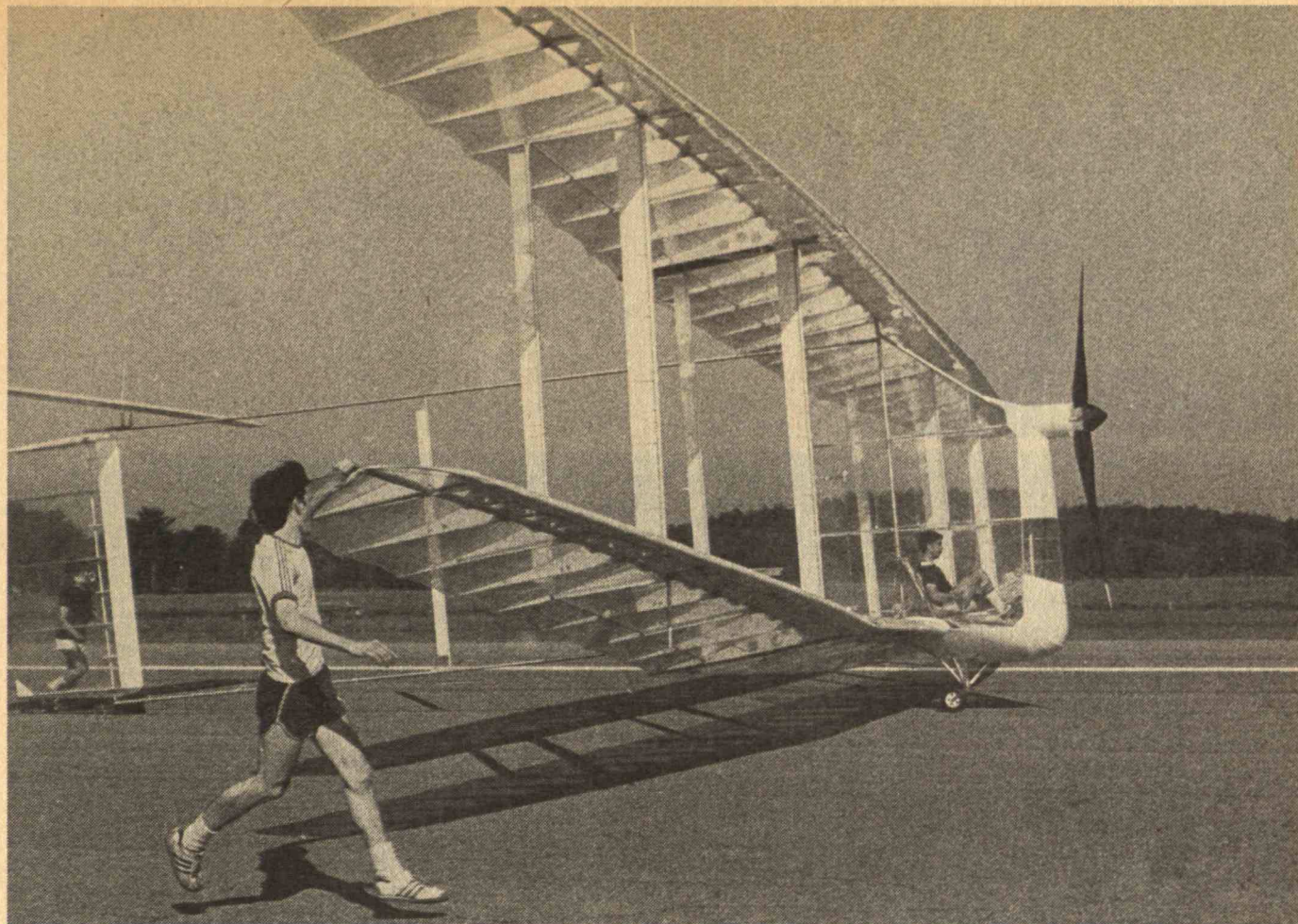
"We are interested in hard facts," emphasizes Professor Larrabee. "Our philosophy," adds Youngren,

"is ease of construction, ease of repair; the same ground rules held by the MacCready group." The key: simplicity, light weight, slow speed, and external wires (if you fly slowly enough, the drag from exposed wires is not detrimental). "Inherent in the idea is that the power must be incredibly low," says Langford. "People don't generate much power." (*Chrysalis* is currently the slowest airplane in the world at 10 miles per hour flying speed.)

MacCready approached his plane as a scaled-up hang glider; members of the Chrysalis Group approached theirs as a scaled-up model airplane. "Stability and control were our biggest problems, so we decided to build a radio-



*More than half the money went for
aluminum tubing alone.*



controlled flying model airplane to test it," explains Parks. "By testing the model we could hope to build something that would work the first time." When the model could take off and maneuver, the team was ready to build it big: picture a 72-foot wing span.

They registered for the same special projects course for spring semester. Then they presented a detailed project schedule and requirements to Department Chairman Jack Kerrebrock to see if he could give them funding. Halfway through he stopped them. "How can I say no?" he said. They got \$2,500 — all they asked for.

More than half the money went for aluminum tubing alone. "The aluminum tubes we needed didn't exist, so we designed the airplane around what aluminum tubing was available. Then we bought half of the current supply in the country. I finally got convinced we would do it when a big box arrived from California with \$1300 worth of tubing," says Parks. It wasn't thin enough (it had a wall thickness of 0.02 inches which needed to be re-

duced to 0.015 or 0.011 according to where it was used), so they had to thin down the walls themselves.

They set up a one-day-only chemical milling plant behind Building 17, complete with hot (160° F.) lye heated by stoves, gas masks (the hydrogen gas given off permeated everything), face shields, rubber gloves and aprons; the solution boiling and bubbling like a witch's brew in 13-foot-long tanks fashioned out of the boxes that housed the tubing.

Careful builders; the same vision

Finally the materials were ready; it was early March. Now mass production started. "We had rib parties every weekend in the basement of the aero department — 12 people doing organized work. Pretty soon everyone knew what it would look like — we had the same conception in mind, even without final blueprints," explains Guppy. "They were talented people who are careful builders working toward the same end." Bob built a machine that cut thin slices of styrofoam (no one

sells it in the 1/8-inch thickness that was needed) and they glued balsa on top and bottom. "It was an immense effort to build the wings — it took from the second week in April until the first week in May," says Youngren. "First we built a 12-foot full-size piece of wing for a test section," adds Parks. "Essentially it was one chunk out of the middle of the wing on which we tried all the techniques to see what kind of problems we would run into on the real plane. And we ran into lots of problems." (Most were with the covering, to keep it taut.)

"The only way to get anything done is to go for 18-hour sessions at a time," explains Youngren. "So much is hanging on one piece building on another, you can't stop. When we covered the plane with plastic film, the session ran from Friday afternoon to Tuesday morning. (The job had to get done — we had a truck arriving Tuesday morning to move it to Hanscom field.) That three-day weekend was 73 hours of work. It generated its own enthusiasm — like a fantasy."

The propeller was the key to the



Foam padding — lots of it — had to be stuffed behind me in the seat so my legs could reach the pedals with a slight bend in the knee when the leg was outstretched; the bike was built for a 6-foot person and I'm 5'4". Sitting in what seemed like a Saran Wrap compartment with bright shiny morning sun reflecting off the runway and reverberating inside my little cell, I felt like part of a fantasy. This is it and don't blow it, I kept thinking. Listen to the directions, concentrate on pedaling.

That was surprisingly easy: the motion was natural with feet strapped tightly. It took much less effort than I expected — I felt the plane lift off before I was putting out 100 per cent effort.

I looked down at people running alongside, one shouting directions; then, confusion. The stick had to be maneuvered carefully to steer and I had no idea what I was doing. The plane was moving off to the left and sharply pointing up.

"Right! Right!" they kept saying and I noticed the left edge of the runway getting much too close — it seemed a very poor place to land. Suddenly the nose lifted too high and I lost altitude. My landing was anything but smooth: I had stalled. Damage to the right wing was minimal, but enough to end flying for the day. No one seemed upset, so I just sat there for a minute and quietly noticed my knees shaking. — M.L.

Photos: page A2-A4, Bob Parks, '79; above, David E. Nawrocki

project and "where we get tied into history," they said. Based on Professor Larrabee's design theories, Bang wrote a computer program used to design the propellers in the preliminary model of the *Chrysalis* and the *Gossamer Albatross* (MacCready's human-powered airplane that won the prize for crossing the English channel last spring). *Chrysalis*' final prop came from it, too. Each seven-foot blade of the *Chrysalis* prop is made of styrofoam covered with Kevlar, weighing 22 ounces. Total weight is three pounds.

"One foot off the ground is a lot — because you did it yourself."

Finally a large space was needed to assemble the *Chrysalis*. They arranged to use a former Simplex building (abandoned industrial space near M.I.T.) with no heat, a leaky roof, huge holes in the floor and a covering of 1/4 inch of dirt. Part of the budget was unexpectedly used to pay \$200 to have lights installed. There the wings were assembled: six wing panels, 24 feet long, six feet wide, with an average weight of eight pounds.

On May 8, a 40-foot moving van transported the plane to Hanscom Field in Bedford, Mass. The pressure was on for a first flight; hangar time was limited. Flying weather is crucial; dawn is the best time for the optimal still air. "It's so fragile that it could be ripped apart in very little wind," explains Youngren.

At what seemed like the last minute (or it would never get off the ground), Friday, June 5, in wretched weather (winds of 7 m.p.h.), Youngren pedaled the *Chrysalis* into the air. It worked the first time — a 15-second flight for

30 feet, three feet high. "It can be one foot off the ground and that's a lot, because you did it yourself," explains Guppy, a bicyclist and experienced sail-plane pilot. "When in the air it's so exciting the tendency is to forget to pedal." That first day was especially nerve-wracking. "It was almost impossible to hold it down — like trying to fly a balsa glider in a 40-mile gale," he adds. The airplane needs 4/10 horsepower — like a bicycle in 10th gear, 80 strokes a minute.

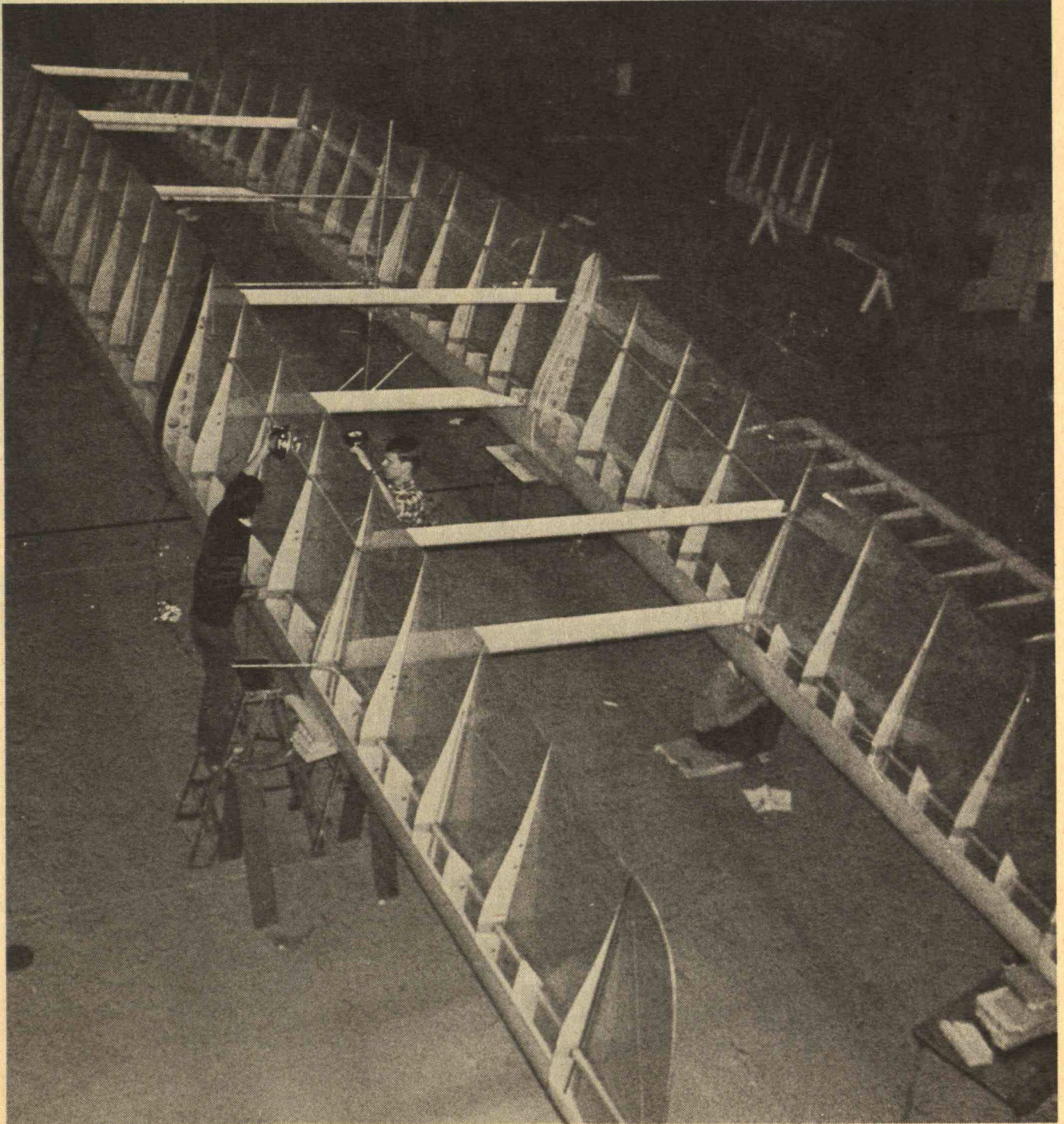
Now came a reprieve: extended hangar time. Each day after that was modification, repairs, learning by trial and error, "back-of-the-envelope engineering," said Guppy. Flying time and height increased; experimenting with turns began.

Parks describes two goals for the 95-pound airplane: to achieve better performance, and to let everyone else fly for fun (20 or 30 people have made contributions of time and effort).

"Building and flying the *Chrysalis* was a once-in-a-lifetime opportunity," says Youngren. ("You look back and say here's this giant thing — as big as a house — and we built it.") And, indeed, an interesting way to get a job. He, Parks, and Langford will continue their teamwork at Lockheed this fall in Burbank, Calif., a stone's throw from their competitors and friends, MacCready's group.

And the fate of the *Chrysalis*? It is to be towed across the country in MacCready's van to a hangar in California. What a relief that it will have space to exist, its silent, magical, stately and whimsical flight to grace the California desert on another windless dawn. — M.L.

"It was an immense effort to build the wings — it took from the second week in April until the first week in May," says Youngren. There were six wing panels, 24 feet long, six feet wide, with an average weight of eight pounds. Photo: Steve Finberg





Technology Day: Innovation, Management Risk-Taking, Regulation — Too Much Talk?

U.S. rates of innovation may not have had a big place in the minds and hearts of 2,000 alumni intent on renewing nostalgic ties with alma mater and classmates at Technology Day on June 8. But soon enough they found a common point of interest: even if innovation is declining in the U.S. as a whole, there seemed no evidence that it is doing so in the Cambridge laboratories which were the object of their visit.

To a full house in Kresge Auditorium in the morning, Jordan J. Baruch, '47, assistant secretary for science and technology in the U.S. Department of Commerce, described his assignment from the White House: an intensive study of what we know about innovation and how to foster it, and recommendations for what Washington could do to improve the amount of speed of innovation and to affect its direction. And — after this job is done, make a similar study — on behalf of our government — for the People's Republic of China.

Pops with Kunzel and Miller — but No Fiedler

To open the 1979 Technology Day festivities, over 2,000 alumni and their guests crowded Symphony Hall on June 7 for "M.I.T. Night at the Pops." The late Arthur Fiedler — who usually conducted on these occasions in a red M.I.T. blazer — was missing, the victim of the heart trouble which ended his life just a month later. In his place was Erich Kunzel, music director of the Cincinnati Symphony's summer concerts, who seemed a sensitive and demanding mentor; Weber's concerto in F major for bassoon and orchestra proved a special delight. The soloist in the latter was John W. Miller, Jr., '64, principal bassoon of the Minnesota Orchestra — apparently the only M.I.T. alumnus to hold a principal chair with a major symphony orchestra.

Governor Edward J. King of Massachusetts was a surprise speaker at lunch on June 8, urging the Commonwealth's dependence on science and especially on the "absolutely unique qualities of M.I.T." Earlier that morning, a panel of students assured the returning graduates that "Tech was and remains hell. If there's anything that doesn't change it's the academic commitment," said Charles G. Eliot, '79.

By the end of the day alumni were complaining that all this had been "too many speeches. . . . We need lots of talking time," said one on a questionnaire sent back to Joseph J. Martori, the Alumni Association's director of class and course programs.

Another complained that his face was red: "How about putting an old yearbook picture on each badge to aid in recognition?" he suggested.

The Managers vs. the Risk-Takers

Dr. Baruch's assignment for new recommendations on fostering innovation wasn't finished as he spoke. But his report to the White House, the audience learned, will have a certain innovation of its own: an equation to relate the important variables of the innovation process. It embodies the "set of resources" at the command of the innovator (or inventor), said Dr. Baruch, and it tries to model the concerns of the "risk-taking decisionmaker." The result is a ratio which, according to Dr. Baruch, is the most important variable in the innovator's decision of whether or not to exploit his idea.

In the U.S. that ratio is the profitability of the innovative investment divided by the profitability of the next-best alternative. In totalitarian countries that ratio might be the reward from success divided by the punishment for failure.

Some of the key elements in the equation: the probability of failure, the present value of future cash flows, costs of marketplace success. From the

Billard Awards and Alumni Honors

Four members of the audience were honored at the Technology Day luncheon as informal fellowship yielded to formal business: Gordon Y. Billard Awards to employees of the Institute for "exceptional service to the community" and honorary memberships in the Alumni Association for "outstanding service to the Association or the Institute."

Billard Awards (provided by a gift of Gordon Y. Billard, '24, in honor of his mother) were given by President Jerome B. Wiesner to:

□ **Mary L. Morrissey**, director of the M.I.T. Information Center, "who has developed that office into a vital center, a major communications link within M.I.T. and between the Institute and the general public," said Dr. Wiesner — "a major role in maintaining the openness and the closeness of the M.I.T. community."

□ **Professor H. Ross Smith**, Director of Athletics, whose "steady hand has guided an historic growth of facilities and programs and . . . dramatic progress toward equality and excellence for men and women."

From Joe F. Moore, '52, retiring president of the Alumni Association, came two honorary memberships:

□ **Helen F. Whitaker**, who, with her husband, the late Uncas A. Whitaker, '23, provided major support "to advancing new and important programs in the life sciences at M.I.T." and who has herself accepted "a strong and influential role in strengthening and advancing many of M.I.T.'s commitments."

□ **John I. Mattill**, since 1966 editor of *Technology Review*, for "a major role in keeping us all informed of new advances in science and technology and up-to-date on the activities, here and off-campus, of thousands of alumni and friends around the world."

Professor Karl L. Wildes, S.M. '22, began teaching electrical engineering at M.I.T. 56 years ago; his friends among the alumni are legion. For him, and for them, that's why there's a Technology Day. (Photo: Margo Woodruff)



How does an innovator decide what to do with his new idea? Jordan J. Baruch, '47 (center, above), assistant secretary of commerce for science and technology, is trying to model the elements of that decision as part of his research on innovation for the White House. After describing his task in his keynote speech at Technology Day, Dr. Baruch joined the panel of M.I.T. experts shown in the picture: (left to right) Professor Myron Tribus, James M. Utterbach, Ph.D. '69, Professor J. Herbert Hollomon, '40, and Dean Robert C. Seamans, Jr., Sc.D. '42.

After hearing Charles Eliot, '79 (left, opposite), and Barbara J. Hill, '80, at a Technology Day panel on student affairs, an alumnus in the audience decided that M.I.T. was all right: students seem especially to be motivated here "to acquire and identify new skills in themselves," he observed. (Photos: Gordon J. Haff, '79)

On Becoming an Honorary Member

The Constitution of the Alumni Association empowers its Board of Directors to confer honorary membership upon individuals who have "rendered outstanding service to the Association or the Institute." That power has been used with great restraint, on the average only a little more than once each year since 1900. This year it was exercised to the benefit and very great honor of this editor (the essential details of the brief ceremony are recorded on page A11).

The privilege of being in the company of perhaps 2,000 people all of whom are his/her readers is given almost uniquely in U.S. publishing to a few fortunate editors of "alumni" magazines every year. The sense of community implicit in that experience is now — for this editor — magnified manyfold. The membership of the Alumni Association is a distinguished, warm, and responsive fellowship, deeply to be cherished. — J.M.

audience President Jerome B. Wiesner asked Dr. Baruch how his model reflects "regulatory uncertainty," a much-cited impediment to innovation. Dr. Baruch's answer: "By extending the time horizon."

Would mathematical notation in Dr. Baruch's formula be too technical for White House consumption? No, Dr. Baruch was told by President Carter's domestic policy adviser: "the President will love it!"

Myron Tribus, director of the Center for Advanced Engineering Study, pressed the issue of regulatory impact at an afternoon symposium: "Regulation hits industrial innovators hard," he told Dr. Baruch. "We have to balance the benefits of free, decentralized competition against the public protection afforded by regulation."

But government regulation can also foster innovation, said Robert C. Seamans, Jr., Sc.D. '42, dean of the School of Engineering. When the automobile industry was required to build cleaner, smaller, safer, and more economical cars, it responded with "real improvements" which represent significant innovation.

Comment from Dr. Tribus: "The skills that make people successful in management don't make good innovators — in other words, risk-takers," he said. Suggestion from J. Herbert Hollomon, '40, director of the Center for Policy Alternatives: let engineering schools return to teaching the essentials of engineering as "product and process," educating the "do-er" who is good at "getting the product out the back door. . . . We should get back to that." (Applause.)

Innovation in Practice: \$60 Million in 15 Years

Alumni who chose to hear this dialogue on management and innovation missed an impressive report of innovations themselves presented by the School of Science at an afternoon session:

□ Malcolm L. Gifter, professor of biology: recombinant DNA research is giving us powerful new tools against disease; in the "not-very-far future," he said, we may be able to prescribe an antibody which can render inactive a specific virus or bacterium.

□ Ali Javan, professor of physics: the first helium-neon laser — a significant technological innovation — was developed at Bell Telephone Laboratories (by Professor Javan) in 1962; now \$60 million of these and similar instruments are sold each year, and the practical uses of lasers are far from fully realized.

□ George M. Whitesides, Cope Professor of Chemistry: just as DNA research suggests the possibility of very specific tools against disease, chemical research is now hinting at ways to make highly specific enzyme action replace or extend traditional reactivity in chemical processes. — J.M.

Signs of Change: From Brotherhood to Siblinghood

Is the M.I.T. of today different — really different — from the school they knew?

After hearing four undergraduates describe their views and lives, alumni returning for Technology Day seemed to agree that, yes — things are different now. But it's not at all clear that they could agree on the differences.

Charles Eliot, '79, (right) who goes to England this fall with a Rhodes Scholarship, emphasized continuity: "If there's anything that doesn't change here, it's the academic commitment," he told 1,000 alumni and guests attending a panel discussion. "And I see no reason why it should change. . . . One of the beautiful things about M.I.T.," he said, "is that the intense, driven person can come here and study such things as poetry."

(Mr. Eliot was a humanities major, interested in creative writing and the history of music. Why did he come to M.I.T.? asked an alumnus. Because he had a youthful passion to be an astronaut, explained Mr. Eliot. He changed his mind but stayed at M.I.T. "because I couldn't get a better education for the kind of person I am.")

Brotherhood and Siblinghood

One change: for the first time in history a woman is president of the Interfraternity Conference. She's Barbara J. Hill, '80, an



enthusiastic supporter of what she calls "the largest and best fraternity system in New England."

Ms. Hill came to M.I.T. partly because it promised her a chance for co-ed living, and she told her Technology Day audience that "it's refreshing to find that brotherhood can be extended to siblinghood."

"Siblinghood?" asked a woman in the audience. "Can you explain that word."

Ms. Hill could: if you have date problems you can talk about them. Women discover that men aren't as different as they thought. They can work together to keep the house going, and they can play together on intramural teams; it's a chance to be with people "as friends and supporters" whichever their sex.

Given such a benign environment, will the M.I.T. experience teach women to deal with the discrimination they'll encounter in the workforce? asked an alumnus. Ms. Hill isn't sure: co-ed living means "a new level of tension" in the group, she admits. But she hasn't encountered discrimination at the Institute, and her answer to the question is probably, no.

Hearing all this and more from other students on the program, one alumnus speculated in the question period that M.I.T. is different indeed. "Most people go to college to become different people," he said. "But they seem to go here to acquire and identify new skills in themselves."

Alumni Officers: Starting Out Fresh

How to start a new year of work for M.I.T.?

For at least 600 alumni volunteers — class officers, Alumni Fund workers, leaders of clubs, and Educational Council members — the answer is clear:

Come to the 1979 Alumni Officers Conference in Cambridge on September 28 and 29.

A full schedule awaits. Alumni Fund workers will attend a workshop at Endicott House on Friday, September 28. Other alumni leaders will meet with students from their areas for lunch on that day and then will attend workshop sessions on alumni relations and high school counseling.

Harold E. Edgerton, Sc.D. '31, Institute Professor Emeritus, will speak on Friday evening following dinner at the Hyatt Regency Hotel, Cambridge. Saturday will be devoted to the annual business meeting of the Alumni Association, the Robert H. Richards Lecture, awards, and presentations on faculty research activities by Professors Francis E. Low, Edward W. Merrill, Sc.D. '47, and Lucian W. Pye. A.O.C. will conclude with a reception tendered by President and Mrs. Jerome B. Wiesner on Saturday at 5 p.m.



To Georges Island with the Former Champion Apathetics: The Class of 1954 After 25 Years

Georges Island was touched with a very soft breeze on that grey Saturday, June 9, 1979. The occasion: M.I.T.'s Class of '54 was back 375-strong for its 25th reunion. Bits of conversation:

"People are friendlier (and perhaps a little fatter) now than they were then. Now we're instant friends."

"How few people have stayed in the field they started in."

"We were always an apathetic class. We couldn't get 5 per cent to come out for a Tech Show. Warshawer claims the Class of '54 had the apathy championship — but we couldn't get anyone to pick up the trophy; with this turn out we've lost it."

"What's the definition of apathy?"

"Look, I didn't know, and I don't care."

"It was keep your nose clean and get through."

"For the past several years the class has been real proud of Paul [Gray]; now Paul has a reason to be proud of the class."

"Remember filling up rooms in a T.C.A. [Technology Christian Association] paper drive — we filled up rooms with paper ... making a 'penny dime' with nitric acid so that a penny came out the size of a dime and we could put it in a Coke machine to get a nickel Coke and change ... the panty raid on Radcliffe — when Dean Fassett went up there to try to stop everyone and he got arrested."

"There is a diversity of people here at the reunion. Students didn't deserve their stereotypes then, either."

"It amazes me that everyone has aged so much, some more than others."

"I was intrigued to come back; it is an awe-inspiring institute; acres of labs."

"It was crazy when I was here."

"When I talk to someone I want to run over and look up their picture in the year-book. You can go to look at your own picture if you want to get discouraged."

"We always went out with Wellesley and Radcliffe students — we didn't treat co-eds well."

Six out of 13 women from the class of '54 returned. For one "M.I.T. was one of the nicest experiences of my life." But she found it hard at first to find a job; there was prejudice against women and no laws to protect them.

"The most noticeable change is all the women. That is a very positive change."

"More people are in management."

"Some guys look exactly the same as when they were freshmen; some are unrecognizable."

"My best friends are the guys I went to college with."



Reunions: Denying the High-Jinks Image

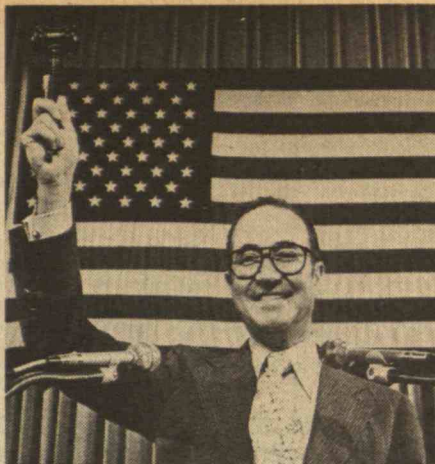
If college reunions are meant to be a time for re-enacting — as well as remembering — the high spirits of undergraduate days, then the M.I.T. reunions of 1979 must be judged failures. Almost without exception, the full two days or more of every one of the 13 reunions was celebrated with quiet good fellowship.

"The younger generations want noise — we don't," said one of the older classmates. But the youngsters hardly wanted noise, either.

Perhaps the only exception was at Historical Collections on June 9, when the Class of 1954 briefly fulfilled the image of the 25-year reunion by asking a professional belly-dancer to enliven its dinner-dance. She did, and Warren Seamans, director, comments that Historical Collections hasn't been quite the same since.

Nine of the reunions occurred entirely in Boston and Cambridge, with housing at M.I.T. Imaginations ran wild: there were Boston harbor cruises, brunches at Quincy Market, dinners at the Hyatt, cocktails and "munchies" at the Pierce Boathouse, a picnic at the Alumni Pool, and clambakes at the Essex County Club and on Georges Island. A few participants complained that they "needed more time to visit Boston."

Rooms for returning alumni and their families were found in every house on the campus, and some of the temporary tenants were clearly bemused by undergraduate tastes in decor, literature, and sound. But mostly the interface between students and alumni was enlightening for both sides. "Our room was grand," wrote one alumnus. "Not enough towels," complained another. Food and drink were so plentiful that it's hard to imagine how anyone could have been either hungry or thirsty; but one was: "Down with continental breakfasts," he wrote. "The human body needs protein in the morning." — J.M.



Responding to applause on being presented at the Technology Day luncheon as 86th president of the Alumni Association, (above), Claude W. Brenner, '47, called for involvement. He hopes as president to inspire and provide means for alumni "to give something of what we have learned in life to the Institute and its students." (Photo: Calvin Campbell)

Resonating with M.I.T. to Feed a "Wellspring of Pride"

Claude W. Brenner, '47, who received his gavel as president of the Alumni Association for 1979-80 at the Technology Day luncheon, regards his role as "far more than ceremonial." He wants to be involved "in more than a superficial way," he said early in July. But he also realizes that the association "is like a giant ocean liner — lots of momentum"; and his is "a small finger on the tiller for only one year."

For several recent years Mr. Brenner (he is vice president-operations of the Northeast Solar Energy Center in Cambridge) has led an Alumni Association committee seeking increasing alumni involvement in all phases of M.I.T. activities. He hopes to further those opportunities as president.

His image is of alumni "resonating" with the Institute, so that both sides gain something very strong from their relationship. It's an experience that should "feed the well-spring of pride that we all take in the Institute," Mr. Brenner told the staff.



Reunion Giving: A \$2.3 Million "Commitment to Excellence"

Reunion gifts totalling more than \$2.3 million were announced at the Technology Day luncheon on June 8. They bring to over \$210 million total giving to the Institute's \$225 million Leadership Campaign, scheduled for completion by April, 1980.

The 50th anniversary Class of 1929 gave President Jerome B. Wiesner the largest of the three gifts announced at the luncheon — \$1,073,606, representing the total of giving to M.I.T. by members of the class during the five years preceding the reunion. Francis M. Mead, reunion gift chairman, had set a \$1 million goal, and he worked hard down to the very last moment to achieve it; 64 per cent of the members of the class had contributed, he said.

In addition, at least 33 members of the Class of 1929 have made plans for future giving to the Institute, promising at least \$875,000.

Some 45 per cent of the Class of 1939 contributed to the \$969,693 which Ernest R. Kaswell, reunion gift chairman, gave President Wiesner. Only one M.I.T. class — 1929 — has ever made a larger 40-year gift, Mr. Kaswell said.

An oversize check symbolic of \$338,119 from the Class of 1954 came to President Wiesner from Robert A. Anslow, reunion gift chairman. It included contributions from 60 per cent of the class, the largest proportion ever claimed by a 25-year class.

In addition, gifts were announced of \$227,223 from the 65-year Class of 1914, \$339,042 from the 60th-reunion Class of 1919, and \$638,240 from the 55-year Class of 1924.

Responding, President Wiesner said the gifts "demonstrate a commitment to continuing excellence — your determination that M.I.T. remain strong," he said. Another evidence of that commitment: a \$2 million anonymous gift (from an alumnus) toward construction of a new Institute house on Memorial Drive overlooking the river.

"Processes in Architecture": How Buildings Are Made

"When a building stands complete and in use, it wants to tell you about the story of its making," wrote Louis Kahn in *Architecture: Science and Light*. This is what "Processes in Architecture," a Hayden Gallery spring exhibit, was about. Sponsored by the M.I.T. Committee on the Visual Arts, the exhibition was organized by guest curators Lawrence B. Anderson, '30, professor emeritus and dean emeritus of the School of Architecture and Planning; and Imre Halasz, M.I.T. professor of architecture. A catalogue accompanying the exhibition features visual documentation and interviews with each of the principals by Lance Laver, a free-lance designer from the Philadelphia area, who holds a M.Arch. degree from M.I.T. The exhibition was an exploration of the process of design and included sketches, drawings, models, photographs, and comments from interviews that paint a comprehensive picture of the evolution of a building from the initial concept through the final result.

First encounters with tracing paper

"Don't think, draw," says one teacher. "It is with delight that architects look back on their first encounters with tracing paper. Superimposing pieces of this translucent stuff over a first sketch, they learn how to change, correct, amplify, filter, reinforce, elaborate, enrich — in short, to 'develop' an architectural design," writes Lawrence B. Anderson in the show's catalogue.

Six design processes are explored. The architects, all of whom were or are associated with M.I.T., include: Marvin E. Goody of Goody, Clancy and Associates/master plan, renovations and additions, Simmons College; Louis I. Kahn/The Yale Center for the British Arts; Gerhard Kallmann and Michael McKinnell of

Kallmann, McKinnell and Wood, Inc./Boston Five Cents Savings Bank; Donlyn Lyndon of Lyndon Associates/Pembroke Apartments, Brown University; John R. Myer and Robert Slattery of Arrowstreet Inc./Chandler Village, Worcester State College and Prescott House, Hampshire College; and Richard C. Tremaglio/the Arena residence (private), Marblehead, Massachusetts. The viewer is shown a step-by-step analysis: reasons for decisions, compromise, evolution of an idea from a rough sketch to the finished building. The buildings are all in the New England area. This gives the viewer the opportunity to take the knowledge gleaned from the exhibit one step further: go to see the real finished product. Some we have passed, obviously, a thousand times, like the Boston Five Cents Savings Bank on School St. near Government Center. They can be appreciated in a unique way when the background — the agony and ecstasy of creation — is known.

The exhibit focused attention on the special quality of M.I.T.'s school of architecture: its view of the architect not as an artist standing apart, but someone who collaborates with his client and builder with an aim towards loose, informal buildings that are "open-ended, ragged and relaxed," says Robert Campbell in the *Globe*.

This description fits the large house in Marblehead designed by Richard C. Tremaglio, '68, professor of architecture. Little roofs, balconies, decks, posts, and beams seem almost randomly assembled. The builder and carpenter added much of the detail while the house was under construction. The result looks picturesque and "jumbled . . . however, fully under the architect's control — and one suspects . . . exciting to live in," says Campbell.

The conceptual sketch is an important moment

The search for imagery that goes into the design of a building is explained by designers of dormitories at Hampshire College and Worcester State by John R. Meyer and Robert Slattery, '70, of Arrowstreet, Inc. (both also teach at M.I.T.). They searched for images in New England aluminum-roofed barns, farmhouses, factories and traditional Japanese buildings.

The 144-page exhibit catalogue (available for \$5.00 from the Committee on the Visual Arts, M.I.T. Room 7-145, Cambridge, MA 02139) is filled with observations of the six architects and guest curators. Some excerpts:

"The profession of architecture is one of problem-solving in relation to the needs of specific clients," writes Professor Anderson. "The aim of designers is not primarily to promote dialogue with critics and peers but to enhance the lives of inhabitants, users, and owners."

"Seemingly simple drawings, sometimes scribbled hurriedly, represent a strong point of view in the design process, a bias, an opinion. . . . The conceptual sketch plays a major role in the generation of all subsequent images and therefore can be considered one of the most important moments in the making of architecture," writes Imre Halasz, professor of architecture.

These sketches and their subsequent development were vividly depicted in the show. The thoughtful visitor will take his new-found insight out into the streets, neck craning to observe all architecture from a new and wiser vantage point. — M.L.

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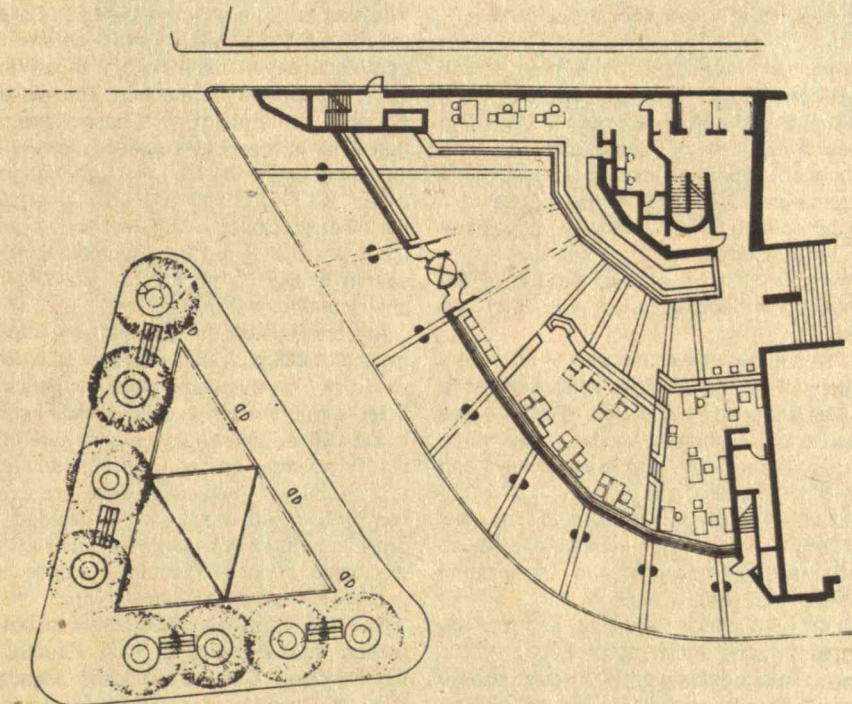
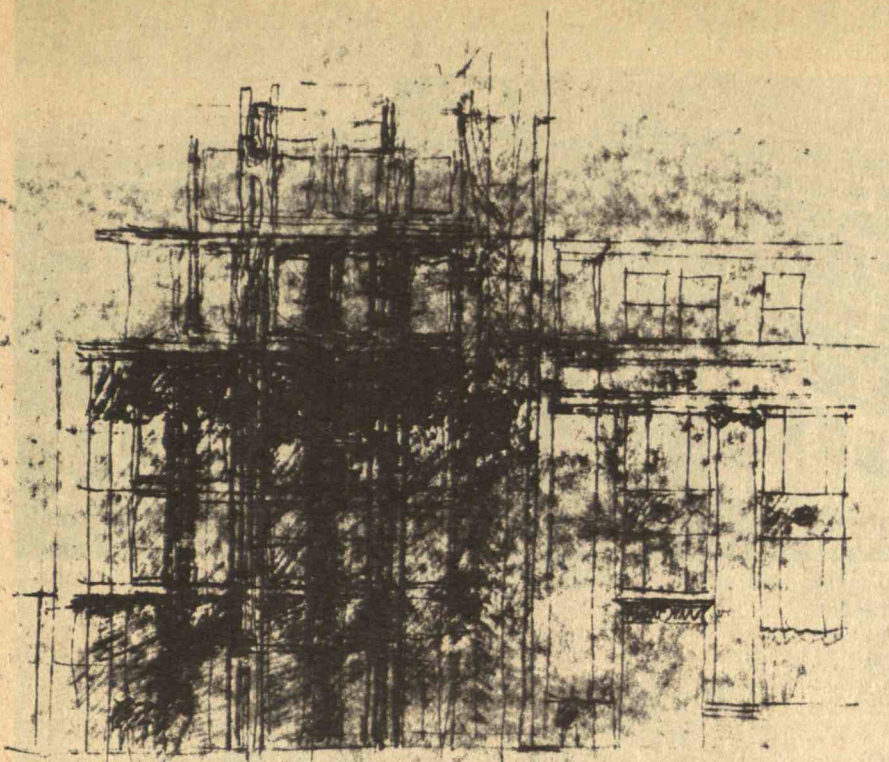
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Above: Design drawings of the Boston Five Cents Savings Bank. Top, window wall; bottom, ground floor. The architects are Gerhard Kallmann and Michael McKinnel of Kallmann, McKinnell and Wood, Inc.

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The six-story atrium of the two-building complex for the Whitaker College and the Medical Department will align with the Institute's "main stem" — the corridor from Massachusetts Ave. through Buildings 7, 3, 10, 4, and 8. To the left in this view (the model looking eastward) are the Whitaker College buildings — 98,000 net square feet of laboratories, support facilities, offices, and class and seminar rooms; the sixth floor will be devoted to basic research in the

brain sciences. The Medical Department building, south from the atrium (right, above), will provide medical offices and a small 18-bed infirmary in 56,000 square feet of space. Architects for the complex are a joint partnership of Gruzen and Partners-Mitchell/Giurgola; and Turner Construction Co. is construction manager. Occupancy is scheduled for September, 1981.

Breaking Ground for Health on a New "Middle East" Campus; M.I.T.'s Largest Building Project Since 1916

They must have been more than a little self-conscious: Howard M. Johnson, Chairman of the M.I.T. Corporation, handing President Jerome B. Wiesner, Mrs. Helen F. Whitaker, and other principal participants chrome-plated shovels in the middle of a cinder parking lot off Carlton St. at Amherst St. in Cambridge.

In front of them a small square of the cinders had been softened, for easier digging.

The square was at the site of an atrium which will be the six-story central entrance to the two-building complex which is to be built for the Whitaker College of Health Sciences, Technology, and Management and the M.I.T. Medical Department. The occasion was the groundbreaking for the new building — held on Commencement Day so that many members of the Corporation might participate.

The \$29 million structure will be the largest physical facility to be built at M.I.T. since 1916, providing 223,000 gross square feet of space. It's the first step in developing what Mr. Johnson called a new "middle east" campus for the Institute — half way between the East Campus houses and the Sloan-Hermann Building complex at Wadsworth St.

Construction is the result of gifts of more than \$10 million from the family of the late U.

A. Whitaker, '23, and \$9 million from the Pew Memorial Trust, Philadelphia. Ms. Whitaker is a member of the M.I.T. Corporation, as Mr. Whitaker was before his death; and seven members of the Pew family have attended the Institute. The Whitakers have made major contributions to support work in the health sciences at M.I.T., including funds for the joint program between M.I.T. and Harvard which predated the Whitaker College. The Pew Trust earlier made a major grant for a combustion research facility in the Landau Building for chemical engineering.

At a brief speaking program preceding the groundbreaking, Walter A. Rosenblith, Provost of M.I.T., revealed that the Institute had flirted with plans for its own medical school in the 1960s. Though it was clear then that the life sciences and engineering had much to contribute to medical science and practice, Dr. Rosenblith said, M.I.T. decided "to grow its contributions more organically" on the basis of local resources; hence the growing collaboration with Harvard.

The new building will bring this concept to fruition, said Irving M. London, director of the Whitaker College; and the adjacent Medical Department building will replace facilities which are now "overburdened, outworn, and fragmented," said Dr. Melvin H. Rodman, medical director.

A Ring for John Harvard's Finger

Early in the morning of Sunday, May 20, the City Desk at the *Boston Herald-American* was enlivened by an anonymous telephone call:

"We, the students at M.I.T., have become fed up with the talk from students at Harvard as to our lack of artistic capabilities. So we have placed upon the finger of John Harvard, founder of Harvard University, a bronze replica of the M.I.T. class ring affectionately known as 'the brass rat.'"

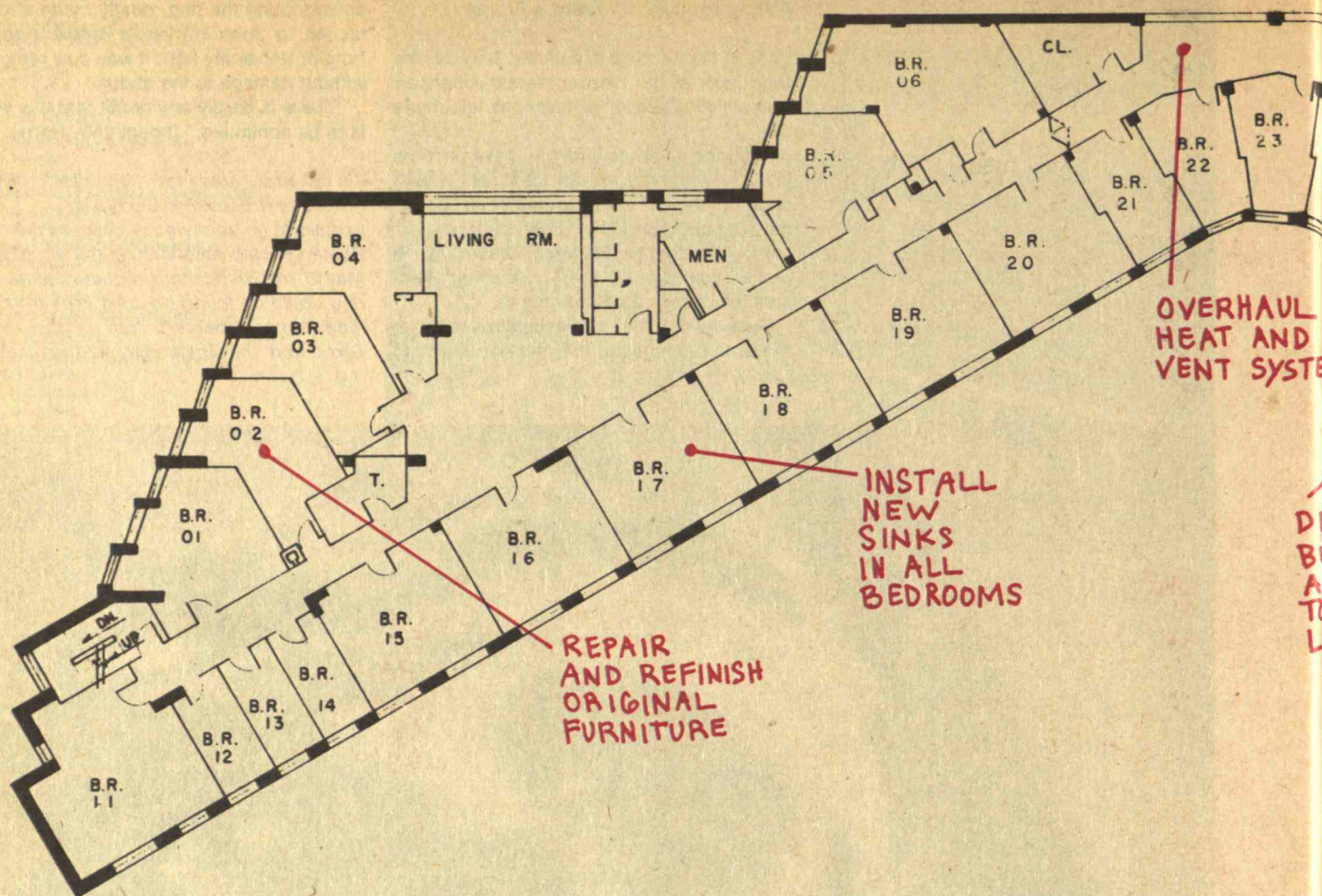
Sure enough: upon investigation, reporter Al Horne (and presumably the Harvard Yard

police) found the ring, neatly made and attached to John Harvard's index finger in front of University Hall. It was duly removed without damage to the statue.

"There is hardly any doubt that this story is to be continued," thought Mr. Horne.

It's called a "brass rat" "because it has a replica of a beaver in the design," explained an anonymous caller to the Boston Herald-American on the morning of May 20, reporting that a replica of an M.I.T. ring could be found on John Harvard's index finger in Harvard Yard. (Photo: Gene Dixon from the Boston Herald-American)





Baker House is 30 Years Old, a Monument of Great Architecture in Need of Repairs

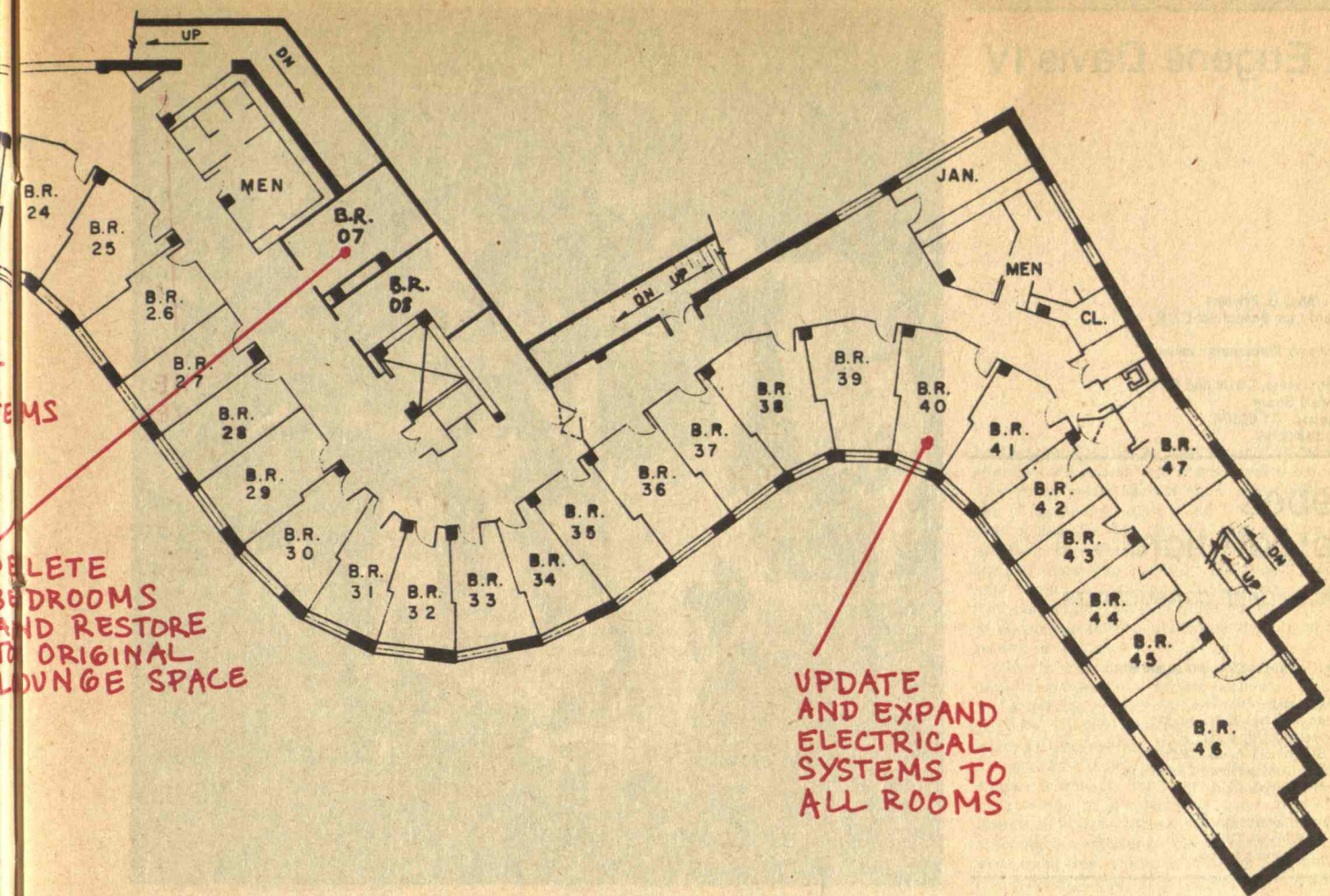
Walk in and you will be surprised.

Any misgivings you may have had before entering Alvar Aalto's Baker House are immediately dispelled.

From the outside the dark red brick is imposing but heavy, the staircase climbing up the wall cuts a strange pattern. But the undulating curves of the side facing the Charles are graceful and unexpected. And once through the door, after a rush of initial delight, further exploration will only heighten the effect. Aalto built for the enjoyment of the students, and he created a design "determined by human experience rather than mere abstraction: the changes in ceiling height that signaled degrees of privacy, the windows placed for the view rather than the formal pattern, the Aalto-designed furniture that never felt cold to the touch or reflected too much sound, the handrail shaped for a satisfying grip — the handrail that was also a continuous visual link from exterior through vestibule into lobby," writes John Morris Dixon, '55, in *Progressive Architecture*. In short, Baker House (one of three buildings the Finnish architect Aalto designed in the U.S.), is one of the most important monuments of 20th century architecture.

The furniture in all rooms is identical, but movable and sized to fit rooms of diverse shapes. (Aalto's plan provided 22 different room shapes in the 43 rooms of a typical floor.) Individuality and unity is the result.

Baker House corridors are not just halls — they curve into wide lounge areas. "The design tends to push people out of their own rooms into a communal setting; it avoids the locked door 'mine' feeling and creates a community. There is no real floor identity — you're part of the house," explains Dean



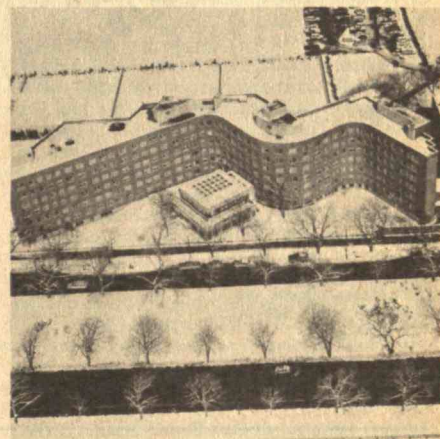
Phillips, '80, a four-year resident. "One stroke of genius — the traffic pattern was worked out so that everyone entering or leaving goes by the same area; it becomes a natural congregating point; a natural flow pattern is conducive to a social atmosphere," he adds.

The physical environment of Baker is indeed unique — and it has declined. Thirty years have taken their toll. Most of the original furniture designed by Aalto needs repair. Bricks need to be cleaned, walls recalked, plumbing and wiring need improvements.

Last spring a concerted effort began to raise the money needed for renovations. "We felt it would be nice for people out in the real world to come back," says Phillips. So they entertained 300 Baker alumni and current residents at the house, to emphasize its architectural significance and raise money for repairs. The goal of the drive is \$250,000 over a three-year period.

Alumni walked around the building looking for their old rooms: "Who is living in my room now, what's it like?" Speakers (Harry Portnoy, Vice President Constantine Simeonides, '20) spoke about the architecture, the history of the design, and past experiences in the house. Uyu Sing Jung from the Jung/Brannen Assoc., Inc., talked about Baker House and Aalto.

"Many schools have definite identification with houses," explains Phillips. "We're trying to build up that sort of bond in this house. We want to avoid the phenomenon of spending four years here and then getting shut out in the cold. We're the first house to tempt alumni back; but we often do things first." — M.L.



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Class rivalry? Well, it's changed (a lot) since the Field Day era . . . this year into an All-M.I.T. Talent Show which displayed all kinds of unexpected prowess. The Logarithms, perennial favorites, devoted one number to serenading an embarrassed Bonny Kellerman, Assistant Dean for Student Affairs. There was dancing by "The Path," Carolyn Towler, '80, and Lanier Leonard, '80 . . . an act called "Six Pistols" with Armen Avanesians, '80, David Slobodin, '81, and George Lesieutre, '81 . . . and a thoroughly remarkable performance on an assortment of beer, champagne, and Coke bottles by the "Burton One Woodwind Society." (Photos: John O. Borland, '80)



03

Our 1903 classmates secured all the honors at Alumni Day, being the oldest class present. Your Secretary was called to stand before the audience to show our youthful activity.

The day program was perfect for outdoor resting. Kresge lectures were on national problems of energy and the high cost of auto fuel.

Your Secretary was again alone and missed **Ike Atwood**, our nearest classmate from Topsfield, Mass., who was on a summer fishing trip in Canada. . . . **Andrey Potter** is still patiently bearing his illness caused by a simple accident. This is to caution our aged group to use a cane at all times like your Secretary, mostly to avoid a fall and broken bones. . . . Mrs. **Foster** highly enjoys receiving the M.I.T. Review and hopes it will not be discontinued since **Stanley** has passed on.

Our precious group of earliest M.I.T. students now are distinctly alone to portray the seriousness and humor of Boston M.I.T. days.

Barry Cox leads our classmates for his life history. Born Nov. 4, 1881, his longevity is due to never smoking or using alcohol, yet he has a sweet tooth and enjoys two chocolate creamers a day. His simple plan is not to overeat. He tries to walk two miles a day.

Your Secretary awaits more classmates' histories for classmate longevity. — **J. J. Nolan**, Secretary and Treasurer, 417 Dorsey Way, Anchorage, KY

08

Mr. Richard Rawlinson, son of **William Rawlinson**, writes that his father is now a resident of Kennebunk Nursing Home, Kennebunk, Maine 04043. Please write him there — he likes to receive mail.

Mrs. **Claude Brown** writes that Claude after graduation worked in the Philippine Islands for about five years and was married there. He returned to the United States in 1913 and worked for the Geological Society for a few years, surveying in Alaska. He then went to the International Paper Co. and worked with them until 1953. During World War II he was with the War Production Board and later with the administration. His first wife died in February of 1969. He was a founder and a charter member of the First Congregational Church of Fort Lauderdale, Fla., and personally supervised the building of the church sanctuary. He was also active with church youth and children in the community. Claude Brown died in April, 1979.

I have received the following information from Frances Luther, daughter of **Howard Luther** who died in February of this year. After his graduation from M.I.T. he remained for two years as an assistant. In 1910 he left for Dresden, Germany to study at the Technische Hochschule. He received the degree of diplom engineer there and then returned to M.I.T. for two periods, ending in 1921. For the following 30 years he was head of the civil engineering department at the University of Con-

necticut. His wife, Ethel Wright, died in 1947. — **Harold S. Osborne**, Penacook Rd., Contoocook, NH 03229

12

Les Duke was honored by a luncheon on February 15 on the occasion of his retirement. More than 200 people attended. Les had been Manager of the Paramount County Water District of Paramount, Calif. M.I.T. Club Treasurer, Burk Kleinhof, represented the Institute at the luncheon. Congratulatory letters were presented from President Wiesner, Dick Knight, Secretary of the Alumni Association, James Hester, Executive Vice President of the Alumni Association, and Ed Ashburn, President of the M.I.T. Club of Southern California. He was honored by the attendance of the President of the Water District, the Chairman of the Paramount Water Commission and other notables. Les worked for 52 years for the Water System, starting with the Clearwater Hines County Water District which later became the Paramount County Water District. Les saw the system grow from 325 services in 1927, when he read meters and did all the billing, to the present 5500 customers.

Harold Mitchell sends his regards to classmates and hopes to be at the 1982 reunion.

William Richardson's daughter reports that William died on March 7, 1979. He was very active after his retirement, working with the Catholic hierarchy in Scranton, Penn., checking the condition and soundness of their buildings.

A belated report tells of the death of **J. Vincent MacDonough** of Watertown, Mass., on October 20, 1973.

Walter Green, who had been living in Palm Bay, Fla., passed away on March 13, 1979, and **John Selfridge** of Ross, Calif., died in November, 1978. — **Philip Dalrymple**, Secretary, 59 Boulder Road, Wellesley Hills, MA 02181

14

Though only five of us — **Ros Barratt**, **Fred Karns**, **Leon Marsh**, **Harold Wilkins** and I — finally made it to our 65th reunion on June 7th and 8th, we had a good time and were sorry only that more of the class couldn't have come. Fred's wife, Margaret, fortunately was able to be with us throughout, and Leon's son and daughter-in-law shared the first evening with us.

When we checked in at McCormick Hall, the dormitory where those of us who came from outside the Boston area were very comfortably quartered, each of us was given a pocket electronic calculator by Texas Instruments and a new type of razor by Gillette. The first event of the reunion was a buffet dinner at the nearby Stratton Building, the student center. From there we went by bus to Symphony Hall for Tech Night at the Pops, where our seniority put us at front-row tables. We were together again at a late breakfast next morning, and then could choose among the

Technology Day events that followed. Most of us attended the Alumni Luncheon, where our class banner was in the place of honor at the right of the line of banners in front of the rostrum. After the gifts of the 25-, 40- and 50- year classes were reported, Dr. Wiesner announced that 1914 had been credited with a reunion gift of \$227,223, the total of our contributions to the Institute for the five years ending on June 30th. He then asked us to stand and be recognized as the oldest class holding a reunion.

Later in the afternoon we went to a big cocktail party on a veranda at Walker Memorial, and then to a small one at the President's House, where Dr. and Mrs. Wiesner greeted each of us. A bus then took us to the Hyatt Regency, on Memorial Drive a bit upstream from the Institute, for our class dinner, a relaxed and very pleasant affair. Because none of us saw any point in trying to change the class officers, we didn't have a formal meeting, but messages from several classmates were read. Next morning, those of us who stayed at McCormick had breakfast together to wind up the reunion.

For the good time we all had we are greatly indebted to the Alumni Association and its capable staff. Joe Martori, Director of Class and Course Programs, designated Ann Perry as 1914 Reunion Chairman. She worked closely with **Harold Wilkins**; the arrangements they made were just right. Another member of the staff, Dorothy Adler, was our hostess at each event. She saw to it that we always had seats and transportation and made us feel that we were the most welcome of guests.

Jim Reber wrote early in May that he and Aminda wouldn't be able to come to the reunion. He expected to drive from Houston to Auburn, N.Y., in mid-June and went on to say, "Fortunately, I am still able to play golf three times a week. The course in the Houston Country Club is tough, with four lakes to drive over, so I have graduated from the 80s to the 90s. In Auburn the course has only two lakes to drive over, so I expect to play my age this summer."

Word came to the Alumni Association early this year that **Frederick A. Dale** had died in January, 1978. He graduated with us in Course I after having joined us in our junior year. The class records show only that he lived in several of the large U.S. cities during the next 20-odd years, was with the Puerto Rico Reconstruction Administration in 1936 and, beginning in 1939, with the Harza Engineering Co., first in Charleston, S.C., and later in Cashiers, N.C., where he lived until he moved to Asheville, N.C., in 1974.

Leon F. Marsh has a new address: 51 Sloane Dr., Framingham, Mass. 01701. — **Charles H. Chatfield**, Secretary, 177 Steele Rd., West Hartford, CT 06119

15

Joyce Brado, our class agent, has made a name for herself with her personal "thank you" letters to many of your contributions to this year's Alumni

Fund. She writes: "You Fifteneers have really come through, as usual. At present, including the classes from 1899-1978 you are about third high in the per cent of active alumni contributing, and I think that is GREAT! Money-wise you also show a fine performance, ranking about 15. Class of 1915 is indeed the Class Supreme!"

Joyce also notes: "I am absolutely delighted to have received so many replies and am enclosing copies of them as news for class notes." **John Dalton** writes: "Thank you for your recent letter and Easter greeting. I do hope you had a pleasant Easter. Our class is very fortunate to have someone like you to keep it going. Our numbers are decreasing steadily. My very best wishes to you."

This excerpt from "The General Electric Story" is from the G.E. publication, "On the Shoulders of Giants," and tells about **Phil Algers'** important contribution to their industry: "The philosophy, Giants," and tells about **Phil Algers'** important contribution to their industry: "The philosophy, 'rules are made to be broken,' in a nice way characterizes the man whose courage, foresight and engineering ability brought many important innovations to electric power during the first half of this century. In 1894, Steinmetz, Pupin, and others engaged in extensive discussions of the merits of the induction motor that Tesla had given to the world a few years previously. It became the role of Philip Alger, engineer and mathematician, to further unravel its mysteries and to make the many technical contributions which would earn for him the name, 'Mr. Induction Motor.' nance Department, U.S. Army. His early work on motor reactance produced first induction motors and then synchronous motors capable of direct, across-the-line starting, greatly simplifying motor controls. His 1928 A.I.E.E. paper, 'The Calculation of Armature Reactance of Synchronous Machines,' remains a classic in the annals of rotating electric machinery."

Evers Burtner writes: "I gave the ship model I made nights (valued at \$5,000) to the M.I.T. Museum in May, 1978; guess that's it for 1978-79."

Alton Cook writes to Joyce: "I haven't traveled much lately. I did not go to California as per my usual program. At 87, I am just slowing down. I do expect to go up to Massachusetts in June, see good old Azel, and stay a few days with my sister-in-law in Reading. The last time I saw Azel was in late October, and **Wayne Bradley** showed up. So, we all had dinner together — a miniature class reunion! Azel is making progress although he has some difficulty writing. We correspond quite frequently. We have an agreement that when we get to 92, I will give up driving... if, indeed, I do make it!"

Dinger Doane keeps going remarkably well, traveling around the country to see his family. He says: "I'm presently commuting to Maine, Idaho, and California, keeping up with 12 great-grandchildren. We're having a great get-together up the north coast, staying at Little River Inn where they serve a real New England clam chowder."

Ellis Ellicott writes: "I know something about the spring weather you have in your neck of the woods. Our spring here has been about normal, but some of the early buds got nipped by frost. Our fishing group had a week in Florida followed by a week at a fishing lodge 30 miles off the coast of Belize City, British Honduras. It is a wonderful place, good accommodations, food and nice people, but to get there you must take a two-hour flight from Miami or New Orleans on Central American airlines. Time means nothing to them; we were three hours late getting back to Miami so we missed our flight to Baltimore and had to spend the night."

Here's a remarkable letter from Dr. **Louis Finck** from Doar Kjør Vilkin, Israel. "I retired from my laboratory a number of years ago, but I have not neglected my scientific activities. I have written several books on thermodynamics, the latest being *Generalized Thermodynamics — Its Philosophy and Rationale*, published by the Jerusalem Academic Press. This past year I have undergone an operation, but thankfully am recuperating well. However, I have been unable to continue my writing, because of lack of energy. Perhaps at 85 it is not surprising. I enjoy living

here in a small agricultural village near my children and grandchildren. We have a house on the shore of the Mediterranean. I receive and enjoy reading the *Technology Review*. Many thanks for your kind letter." It's good to hear from him. The rest of his address is Beit-Yaneh, 40L93, Israel. — **Azel Mack**, Secretary, 100 Memorial Dr., Cambridge, MA 02139

16

Although we were only a small group, we thoroughly enjoyed ourselves at the Chatham Bars Inn for our 63rd reunion. Several last-minute cancellations kept several "regulars" from attending. Gladys and **Francis Stern** were ailing and couldn't make the trip. Frances and **Henry Shepard** called the Inn to say they would be a little late and a second phone message said that they couldn't make it. **Charlie Reed** wrote: "Sorry, but Mil has to attend twin grandsons in Houston. We want to keep them breathing." **Dan Comiskey** wrote: "Sorry, but we just can't plan to go this year." **Charlie McCarthy**: "Am pleased that so many of our old friends are planning to attend the 1916 reunion. Unfortunately, we shall be unable to be with you. Please give our regards and best wishes to all hands for a happy time at Chatham and good health for the future." **Doug Robertson**:

"I have delayed writing you in the hope that we might be able to go. I am sorry that Bettina caught a cold which turned into bronchitis and the doctor does not want her to go. We wish that we could join you on this happy occasion but we can only look forward to next year." From **Dave Patten**: "I refuse to admit that age is sneaking up on me — as the saying is 'Don't look behind!'; but there are complications that come with the years such as broken bones — my right kicker (leg bone), a neck (three vertebrae) and more recently my right hip. On the weekend of the reunion, Dorothy's granddaughter gets married, her namesake; and although Dorothy had major abdominal surgery, everything is 'go' except the reunion. Greetings to all from the 80 plus years." **Ed Parsons** wrote: "Mary and I have been planning all year to get to the 63rd reunion this year. But now the gasoline crisis raises its ugly head and with supplies here somewhat limited we have decided that the safest thing is to stay put here. We hope we can make it next year. As usual we had a wonderful six months at our home on Plantation Key, Fla., with the most beautiful weather we have seen there in 18 years. We have been here ten days and had one sunny day! We stopped driving to Florida two years ago and now fly. On our way north we stopped at Memphis, Washington, Philadelphia and Greenwich, Conn., visiting cousins, daughters and granddaughters arriving here completely exhausted by continuous parties given for us."

Frances and **Paul Duff**; Frieda and **Hy Ullian** and their son Joe; **Nat Warshaw**; **Barney Gordon**; **George Crowell** and his son, Bruce and Bruce's wife, Betty; Rose and **Bob O'Brien**; and Sibyl and **Ralph Fletcher** attended the reunion. We had a marvelous two days, including our clambake at the seashore. Our red jackets blended in very nicely with those of the Class of 1929 who were celebrating their 50th at Chatham at the same time. As usual our enthusiasm for continuing annual reunions at Chatham doesn't diminish, and we'll go back there again next year. However, so that we might generate contact with others we will schedule a fall meeting. Tentatively, the plan is to have a luncheon at the M.I.T. Historical Collections in Cambridge, at which time the original "Red Jacket" and other class memorabilia will be given to the Historical Collections. We would be happy to have your suggestions on this."

Sorry that **Jap Carr** wasn't at the reunion to hear the words of praise for his untiring and effective work as our Class Agent. Jap has set a high goal for us for 1981, but with his inspirational leadership we can achieve it. **Nat Warshaw** encourages us to keep walking. He tries to walk five miles a day and continues it in California in the winter when conditions in Massachusetts make walking hazardous. . . . **Barney Gordon** continues to be very active and from time to time during the

reunion hummed or sang a few bars of some of our old favorites. . . . **Hy Ullian**, **George Crowell** and **Ralph Fletcher** are still very active in their businesses. . . . **Paul Duff** continues to add zest to every gathering with his enthusiastic story telling. He missed the presence of **Francis Stern** who always had a comeback story for every one that Paul tells. It was a great reunion! . . . **Joel Connolly's** note: "Active in education regarding early diagnosis and treatment of diabetes. Member of Board of Tucson Diabetes Association; Board Member — American Association of Retired Persons; Program Chairman — Freighters Travel Club."

We'll close with **Cy Guething's**, "keep breathing" and **Nat Warshaw's**, "keep walking." — **Ralph A. Fletcher**, Acting Secretary, P.O. Box 71, West Chelmsford, MA 01863

18

For it's always fair weather
When good fellows get together
With a stein on the table
And a good song ringing clear.

Such was the spirit on June 7 last at Alumni Day in Cambridge. Gathered together on this happy occasion were **Eli Berman**, **Len Levine**, **Julie Avery**, **Nat Krass** and Hannah Katz, Rhoda and **Charlie Tavener**, and Selma and **Max Seltzer**. The class of 1918 had a unique history with two years at the Tech on Boylston Street and two years at the M.I.T. campus across the river. We had much to look back on (those days at Copley Square) — and still much to contemplate for the future in these magnificent buildings along Memorial Drive.

A news item in the *Tech Talk* brings to mind **Carlton Tucker** — this year the award in his memory for excellence in teaching was presented to Kaigham J. Gabriel of Philadelphia, a graduate in electrical engineering and computer science.

In a recent issue of the *New York Times* is this comment from **Herb Lerner**: "To the Editor: It would seem that if the politicians in Washington who are denouncing the oil barons so vehemently could run our country with half the skill and efficiency that oil company executives are demonstrating in the conduct of their businesses, we'd be a nation of very happy, prosperous, contented people."

We note with sadness the death of **Clarence Fuller** on May 26. It was my privilege to have been in close touch with Clarence for many years. He was a most loyal son of M.I.T. — a true friend — and will be missed by the many fortunate to have known him. He joined the Foxboro Co. in 1920 and retired in 1967 as vice president for sales. He leaves his daughter, Mrs. Jane Claire Beck, and two brothers.

I am indebted to William Lane, '52, for this letter with a short resume of his father's (**Frederic Lane**) career. "Most of my father's business career was with American Electric Power Service Corp. in New York. After a 35-year career he retired in 1960 as deputy chief engineer. During his later years he lived in Wakefield, R.I., and became involved in land development and house building. Throughout his life he was involved in ham radio affairs, having first been licensed in the early 1900s. As a second generation Tech graduate, I was pleased to read your column in the *May Technology Review*."

We note the deaths of **Ed Mead** on May 1 and **Lawrence Flett** on June 29. — **Max Seltzer**, Secretary, 60 Longwood Ave., Brookline, MA 02146; **Leonard I. Levine**, Assistant Secretary, 539 Washington St., Brookline, MA 02146

19

Because of space limitations, this issue of 1919 class notes will be mostly devoted to the 60-year reunion celebrated in Cambridge on June 7, 8, and 9 of this year.

First, the names of those who attended: **George Michelson**, **Lou Grayson** and his wife Ilene,

Robert MacMullin and his wife Olive, **William Vogt, Don Way** and his wife Barbara, **George Bond Jr., Ev Doten, Ralph Gilbert, Russ Palmer, Milt Loucks** and his wife Catherine, **Royden Burbank, Bill Langille** and his wife Florence, **Buzz de Lima** and his wife Suzanne, and **Larry Riegel**. Others who planned to attend but were prevented by late developments were **Fran Weiskittel, Doc Flynn** and his wife, **Aubry Ames** and his wife. Several others wrote of wanting to attend and had to miss the Reunion, **Tim Shea, Paul Blye, John Stevens** to name a few.

The attendees were comfortably accommodated at the Hyatt Regency Hotel with ready access by bus or taxi to the ceremonies at the Institute. The highlight of the ceremonies was the Class Dinner on Friday evening, where the speaker of the evening was Irwin Sizer, Dean Emeritus of the Graduate School who, in company with his wife, shared dinner with us. Professor Sizer spoke of the many changes in the Institute since our class started in Boston and after one year moved to Cambridge; we can now look back over 60 years and see Boston Tech become an institute commanding world attention. The dinner was graced by the attendance of Jean Sheeline, wife of **Paul Sheeline**, and three guests from the Alumni Association. Cameras were much in use and a class picture with a 1919 banner as backdrop was taken. It was a heart-warming affair that all will remember with pleasure. Members of the class met and bravely voted to have a 65-year reunion in 1984. The present officers were continued and President Way was authorized to appoint back-up assistants for each office. It was duly decided to make Irwin Sizer, our guest speaker, and Mrs. Jean Sheeline honorary members of the class. The class recognized the special help and considerations by the Alumni Association, and thanks should also be extended to Don Way, George Michelson, Ev Doten and the late Paul Sheeline for their service in arranging and conducting the Reunion; these things do not just happen. — **W. O. Langille**, Secretary, Box 144, Gladstone, NJ 07934

20

A goodly number of classmates turned out for Technology Day last June. Present at the luncheon were Mina and **Perk Bugbee**, Pat and **Buzz Burroughs**, Kay and **Frank Maconi**, **Ed Wason** and his daughters, **Ed Ryer, Jack Nolen, Phil Wait** and your ever-present secretary. A meeting of the reunion committee was held that afternoon and tentative plans were made to hold the 60th Reunion on campus with a banquet at a convenient and choice location. Detailed information will be forthcoming shortly. Meanwhile mark down that date — June 5-6 — and resolve to be on hand. It promises to be a memorable occasion.

A cheerful note from **Jim Wolfson** of Hollywood, Fla., says that at the newly formed Broward County M.I.T. Club he was the sole representative of our class. Says Jim, "Having celebrated my 80th birthday last month, I believe I was the youngest member of the oldest class present. To show how old we are, if we were 80 in 1916 we would have been eligible to fight in the Civil War." That is surely food for thought, Jim. He also writes, "Hope to see you at the 60th."

Elbridge Wason has moved from 9 Edgewater Dr., Wellesley Hills to 48 Wyman St., Waban, Mass. A note from **C. Theron Van Dusen** of Bloomington, Mich., discloses that he is serving on the board of trustees of William Beaumont Hospital and the Arnold Home for the Aged at Camp Oakland, Mich. Good for you, Theron!

A letter from Mrs. **Edward L. Cochran** of 6251 Old Dominion Dr., McLean, Va., contains interesting information about our illustrious classmate. Ned, who had served as vice president and advisor to President Jim Killian, died in 1959. After graduating from the Naval Academy he entered M.I.T.'s naval architecture course, which was interrupted by World War I, when he was ordered to Philadelphia Navy Yard. When the war ended he returned to M.I.T. to finish his course and graduated with us in 1920.

Mrs. Cochran has established two awards in Ned's memory, one an award for "best buy" — qualities in humility, leadership and scholarship — and a sailing award, the Cochran Corp. A rowing shell was named the *Vice Admiral Cochran Shell* by M.I.T. in 1953. As the shell was showing signs of old age, Mrs. Cochran donated the money to replace the original shell and the new one has been promised delivery at about the time these notes appear. It will be appropriately dedicated to Ned's memory at fitting ceremonies. Mrs. Cochran writes: "You seem to have many lively members whom I read of in your class notes." We are exceedingly grateful for her warm letter and for her generosity to our beloved Institute.

The sister of **John DeMeulenaer** of 21 Overcroft Rd., Dorchester, writes to inform us of John's death on May 10th. After graduating from Course I, John served the City of Boston as division engineer, bridge and highway construction, for 32 years before retiring in 1953. Last year he and his wife Madeleine celebrated their 55th wedding anniversary. John was a credit to our class and shall be missed by us all.

William Henry Preston, Jr., writes to inform us of the death of his father on April 3 in San Juan, Puerto Rico. **Bill Preston**, a graduate of Course II, had been retired for many years, but his son says that he was always very proud of his profession and of being a graduate of M.I.T. I speak for the class in expressing condolences to his wife and children. — **Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, MA 01890

21

The M.I.T. Club of Northern New Jersey held their annual dinner meeting in late May and it was your secretary's pleasure to sit next to Dorothy (Mrs. **Joseph Wenick**). I learned she is selling her house in Caldwell, N.J., but will continue to come north every summer from her winter home in Florida.

Helen and **Bob Miller** stopped in briefly to see Betty and me on Memorial Day on their way to their summer cottage on Cape Cod. Helen has recovered well from her surgery of a year ago, and they both look fine.

Irving Jakobson reported that the Alumni Day luncheon had the following attendees from 1921: "Helen and **Bob Miller, Don Morse, Edmund MacDonald, Frank Whelan**, myself, and as a pleasant surprise, Helen St. Laurent. All hands seemed to be in good health and enjoying life, with the advancing years treating us kindly."

An alumni fund envelope from **Glenn H. Easton**, U.S.N., says, "My wife Cornelia and I enjoy an ocean front apartment on Satellite Beach, Fla. We belong to Patrick A.F.B. Officers' Club two miles north. We still own our summer home near Colby College, China Lake, Maine, and go there in the summer months."

News was received of the death of two of our classmates: Captain **Alfred H. Baisley**, Reedsville, N.C., on March 17, 1979, and **Ralph M. (Rufe) Shaw, Jr.**, Beverly, N.J., on May 20, 1979. Rufe was the owner of the Pedrick Tool Co. and was still active in the business. He was the holder of numerous patents and reported every year the "business is booming, backlogs bigger than ever, and I can still keep on top of the grocery bills." Rufe attended all our reunions and his wife Madeline entertained us more than once at the piano. We shall miss him.

As these notes are being written away from home, I am unable to give further information on Captain Baisley.

One other death, that of my college roommate Hobart A. Fischer, '22, is reported here, as many of the 1921 men knew him. He worked for New England Telephone Co. and became traffic manager for Vermont and New Hampshire. His home was in Daytona Beach, Fla. Our sympathy goes out to the families of these men. — **Sumner Hayward**, Secretary, 224 Richards Rd., Ridge-wood, NJ 07450; **Josiah D. Crosby**, Assistant Secretary, 3310 Sheffield Cir., Sarasota, FL 33579; **Samuel E. Lunden**, Assistant Secretary, 606 S. Olive St., #701, Los Angeles, CA 90014

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Your Secretary's inspiration for these notes came from receiving the *Mountain View Road News* of June showing a beautiful colored picture from **Bunt Spalding** of the lodge of Spalding Inn Club and cottages at Whitefield, N.H., in the heart of the White Mountains, north of the Presidential Range. Their summer and fall program sounds most attractive as it brings back memories of our Post-55th Reunion with 20 classmates for a glorious three-day stay.

A Wellesley College reunion in June brought together two daughters of our Class at their 30th Reunion. Joann Johnson Douglas of Muncie, Ind., told my daughter, Barbara Ferguson Federlein, that her father, **Ab Johnson**, is getting around much better after having a hip operation. She is planning a large party for his 80th birthday. Dorothy and I remember seeing the Ab Johnsons at the Wellesley graduation on a hot day in 1949.

We have found that **Norman J. Greene** is a former Governor-General of the General Society of Mayflower Descendants (most of our folks came over after that time).

P.S.: "**Pat**" **O'Brien** is publishing the quarterly periodical *Alcohol Affairs* — circulation 12,000. He is president of this non-profit corporation in Baton Rouge, La., at 2160 Terrace Avenue.

Your Secretary talked to **Frank Kurtz** in Florida in March and tried to call others, including **Oscar Horovitz**. While there we enjoyed the Panama Canal trip from Fort Lauderdale to Acapulco on the *Fairwind*. We returned by air through a snow and sleet storm in Dallas!

C. Randolph Myer, Jr. continues to run his business in Wilton, N.H. He attended the annual reunions we had many years ago at the Boston Statler Hotel before the alumni banquets. Your Secretary had airplane reservations, luncheon and reception tickets for June 8th this year and was sorry to cancel out on that day. Will those who attended please send notes to Buffalo — quick.

Mr. and Mrs. **Ray C. Ellis**, Dark Harbor, Islesboro, Me. 04848, have sent a card describing a most beautiful setting around their home. We hope to hear more about their tennis and M.I.T. picnics. Their November-to-May address is 5858 Midnight Pass Road, Sarasota, Fla. 33581.

William B. Elmer's (R.D. Campton, Thornton, N.H.) book *The Optical Design of Reflectors* is being set in type these days by John Wiley & Sons and is expected to issue in November. This has nothing to do with his 213 slides of Voodoo drawings of cartoons, pictures of fair maidens and nymphs and assorted headpieces. Bill is now giving slide shows of these drawings to the 50th Reunion Class of '29 at Chatham Bars Inn and to the 55th Reunion Class of '24 at Exeter Inn. Bill writes that he enjoyed a magnificent lobster clambake at Exeter and a luxurious overnight stay in Chatham.

We are sorry to report the loss of **Allen S. King**, former president and chairman of the board of Northern States Power Co., after a lengthy illness. His lifetime of work with the company covered all phases from his original engineering on construction projects to the presidency and chairmanship in 1968. Allen was especially active in community activities including the Boy Scouts and United Fund.

Our sympathy is also extended to the family of **Russell Hopkinson** of New York City and East Hampton, Long Island. He was a former vice-president of Olin Mathieson Chemical Corp. and a pioneer in the development of synthetic rubber.

We must also report the passing of **Dr. Walter Willard Boyd** of Bethesda, Md.; **Frank L. Youngs** of Mesa, Ariz.; **Kenneth F. Morgan**, Newport Beach, Calif.; **Harland Wilbur**, Winchester, Mass.; **Clarke T. Harding**, Orlando, Fla.; **E. Austin Rice**, North Olmstead, Oh.; and **Howard M. Spooner**, Summit, N.J.

Again, please send your gas-starved Secretary some news, clippings, photographs or three rousing cheers — **Whitworth Ferguson**, Secretary, 333 Ellicott St., Buffalo, NY 14203; **Oscar Horovitz**, Assistant Secretary, 3301 South Course Dr., Pompano Beach, FL 33060

Royal Sterling says that all systems are "go" for our 56th reunion, September 7 to 9 at the Ramada Inn on Route 95 at Mystic, Conn., and that the place is lovely with many interesting spots to see in the neighborhood. Late deciders who have not made reservations but wish to go should call Angela Arnold at 203-536-4281.

The National Academy of Sciences Medal was awarded to Ida M. and **Cecil H. Green** on April 23 "for their outstanding role as discriminating donors, seeking those opportunities where their support of science could make a qualitative difference — to people and to institutions." Mrs. Green was elected a Life Member of the Institute's Corporation on June 4. Helen A. Whitaker, widow of the late **Uncas A. Whitaker**, was also elected a Life Member of the Institute's Corporation on June 4, and she was made an honorary member of the Alumni Association on June 8.

At the Awards Convocation on May 11, 13 **William L. Stewart, Jr.**, Awards were presented to students who had made outstanding contributions to extracurricular life. Bill was a member of the Corporation from 1952 until his death in 1963.

William B. Greenough, Jr., Pete Pennypacker, Kay and Julius Stratton, and your Secretary-Treasurer represented the class at the Technology Day Luncheon on June 8.

Marge and **Tom Rounds** have recently returned from a week in England and a nine-day cruise to Ireland, Isle of Skye, Shetlands, and Norway.

George Bricker writes that he still is publishing *Bricker's International Directory of University-Sponsored Executive Development Programs* and has opened a law office in Dennisport, Mass.

Franklin Clement writes that he retired in 1964 as senior vice president and director of E.P. Hutton and Co., Inc., that he still plays golf and has shot his age or better 226 times to date, that he lives in Florida nine months and in Michigan three months of the year, and that he and his wife (second marriage for each) have 21 grandchildren between them, which keeps them young and active.

Rosalie Margaret Karapoff Cobb writes that on May 9 she received a plaque marking 50 years membership in the Technical Association of the Pulp and Paper Industry.

Jacob A. Effenbein writes, "As of this date. (March 1979) my Gross Take-off Weight Computer is still flying around the world, carrying cargo aboard Flying Tiger Lines, Seaboard World Airways, etc., daily."

E. Fletcher Ingals writes, "We moved in late 1978 from Groton (Mystic), Conn., to Del Mar in the San Diego area of California to spend our retirement years with our son and his family." His new address is 13366 Caminito Mar Villa, Del Mar, Calif. 92014.

Albert H. Steinbrecher writes that at 82 tempus fugit, but he still is very active on amateur radio. . . . **Scott V. E. Taylor** writes that he is engaged in a study of outer space phenomena and variation in meteorological conditions as they affect his health. . . . **William W. Upham** writes that he is past president of the St. Petersburg Board of Realtors, past president of the Gulf Beach Rotary Club, and a trustee of Eckerd College for nearly 20 years of which he served for six years as treasurer of the Board.

The Alumni Association has reported the deaths of Colonel **Frank J. Atwood**, **Edgar D. Deming**, Dr. **Joseph L. Hetzel**, and Brigadier General **Harris Jones**.

Frank Atwood died May 1, 1979. He was born in Bradford County, Penn., graduated from Washington State College and the University of Michigan, and attended the Institute in 1923 as a Captain in the Ordnance Department. He was a veteran of both World Wars and retired from the Army in 1946. His last assignment was as chief of the Rochester Ordnance District in New York for 10 years before a second retirement.

Edgar Deming died sometime in August, 1978. He was born in West Roxbury, Mass., and graduated in business and engineering administration with our class. No information concerning his

career is available.

Joseph Hetzel died April 30, 1979. He was born in Southport, Conn., studied biology at the Institute, went on to the Yale School of Medicine from which he graduated in 1926, and became a practicing pediatrician in the Waterbury, Conn., area. He was attending pediatrician at the Waterbury Hospital; member of the Waterbury Medical Society, New Haven County Medical Association, the Governor's Committee on Fitness, and Connecticut State Medical Association; fellow of the American Academy of Pediatrics; chairman and director of the Waterbury Chapter, American Red Cross; cofounder of the Connecticut Advisory School Health Council; and member of the School Health Committee, Connecticut. He also was a member of the New Haven M.I.T. Club, a director of the Waterbury (Conn.) M.I.T. club; a member of the Middlebury Conservation Commission; and vice president of the Middlebury Land Conservation Association, Inc. — **Richard H. Frazier**, Secretary-Treasurer, 7 Summit Ave., Winchester, MA 01890

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The trembling and excitement of your 55th Reunion Committee mentioned in the last Notes was mollified by the afternoon of June 10 when most of the 62 attendants at the Exeter Inn scattered like dandelion pappi in the wind. We counted 77 taking part in the Wednesday informal dinner; Thursday harbor cruise, Pier 4 luncheon, Quincy Market tour, Pops; Friday Kresge "Science and Engineering" speakers, Memorial Service, Rockwell Cage luncheon, Exeter Inn, lobster dinner; Saturday games, rocking chairs, roast beef dinner, officer election, former reunion movies; Sunday auf Wiedersehen.

The non-scheduled entertainment of the evenings was **Ed Moll's** distribution of *What the Old-Timer Said* paperbacks by Allen Foley, a white elephant episode, a **Nish Cornish** Mexican lottery, and duets by Kathy Davol and Eva Walthall with **Dippy Davol** at the piano, proving that the digits are still flexible. Outstanding white elephant gifts were two water colors by **Eric Brater**, prominent Cleveland artist. Nish gave away many brightly colored handmade articles, including several beautiful serapes.

An important part of Technology Day is the announcement of gifts and awards. Special recognition was given to post-50-year classes. Our \$630,240 topped the list. One of our own **Gordon Y. Billard** Awards was presented to Professor Ross H. (Jim) Smith, Director of Athletics, in recognition of his service of outstanding merit to M.I.T. Your scribe has worked with Jim for many years, and I am happy to see his untiring efforts recognized. Our class voted to donate \$2,000 of class funds for a chair in the refurbished Room 10-250. And, always reliable and dedicated **Nat Schooler**, in a mellifluous gesture, matched our action establishing a Nathan and Freda Schooler chair.

A letter from the wife of **R. Newell Waters** advises that he passed away January 10, 1979, in Weslaco, Tex. Although he was not a graduate in architecture, M.I.T. was very close to his heart and Mrs. Waters has provided a memorial gift in his name, suggesting that it be used to further architectural education in some of its many needed facets. Newell practiced in southwest Texas for forty years, accumulating nationwide friends in his profession.

William C. McHenry died April 4, 1978, in New York City, apparently retired from Pennsylvania Power and Light Co. He was a Course XV member and at times lived in Allentown, Penn., and Washington, D.C. The death of **Joseph H. Christoph** was reported in the *Manchester (Conn.) Evening Herald* of May 3, 1979. He lived in Manchester for 30 years and had retired from Mobil Oil Corp. He studied chemical engineering at the Institute and was a 20-year Navy veteran of World Wars I and II and assistant director of the Officers' School at the Hartford Training Center.

Briefs from Alumni Fund envelopes: **Austin Cooley**, Reno, Nev. — "Still working on fax for

transmission of X-ray films." (He attended our 55th with wife Helene and 7-year-old daughter Donna). . . . **William E. Delehanty**, New York City, N.Y. — "Retired. Now active in painting (mostly watercolor and acrylics), sculpture and pottery." . . . **Everett E. Elting**, Scarsdale, N.Y. — "Continue as vice president of International Executive Service Corp. Send to developing countries highly skilled executives — mostly retirees — as short term advisors. Have sent out over the past 15 years hundreds of M.I.T. alumni." . . . **J. Earl Frazier**, Washington, Penn. — "Elected to the National Academy of Engineering 1978." . . . **J. Herbert Grahame**, Escondido, Calif. — "Marguerite and I are both active and well, enjoying life as residents of Redwood Terrace Lutheran Retirement Home where we have resided for the past year after selling our home in Rancho Bernado. Enjoyed very much having Mr. Hugh Darden stop in for lunch with us a week ago on his way to Los Angeles." . . . **George H. Holmes, Jr.**, Paradise, Calif. — "Sorry I can't be there for the 55th Reunion, but wish you all the best of luck." . . . **Douglas Montgomery**, Oxnard, Calif. — "In good health, but not doing anything special. Still in Ventura, Calif." . . . **R. Paul Schrieber**, Midland, Mich. — "We enjoy summers in Midland and winters in Dunedin, Fla. Will be unable to attend 55th Reunion — having a family reunion at same time. I'm recovering from two lens implants."

Lawrence B. Feagin passed away May 7, 1979, in Vicksburg, Miss., after a long illness. Dick received his S.B. in civil engineering after an A.B. from Vanderbilt University. He immediately joined the U.S. Army Corps of Engineers at Wilson Dam in Tennessee and served the Corps for more than 40 years.

He was district engineer at St. Louis during World War II, then chief of the Upper Mississippi Valley Division, moving to Vicksburg in 1954 as chief of construction, Lower Valley Division. His specialty was potamology, soil mechanics and foundation engineering, representing the Corps here and abroad in conferences. He was a violinist, featured on the Musical Club programs and reported as a musician of extraordinary ability.

We were happy to receive career information on **Frederick Emmons Terman**, world-renowned electrical engineer, who received his Sc.D. from the Institute with us. He received an A.B. in chemistry in 1920 and his electrical engineering degree in 1922 from Stanford University. He began his career there as an instructor in electrical engineering, advancing to professor, executive head of the department, dean of the engineering school, provost, vice-president, acting president and emeritus in 1965. Fred was the spark and ultimate big blast of the famous Hewlett-Packard Co. He was a scientific educational consultant to the U.S. Government, several colleges, organizations and councils, receiving the National Medal of Science from the hands of President Ford. In 1978, President Carter wrote saluting and thanking him for a "truly admirable career." In 1977, the distinctive \$9.2 million Terman Engineering Center Building was dedicated at Stanford University, a gift of the Packards and Hewletts. The Sibyl Walcutt Terman Memorial Fund in the School of Education was established to promote Fred's wife's interest in methods of instruction in reading and basic skills. His awards and honors were international, based on fundamental research in the fields of radio, electronics and transmission in collaboration with the U.S. Government Defense Department. — **Russell W. Ambach**, Secretary, 216 St. Paul St., Brookline, MA 02146; **Herbert R. Stewart**, Co-secretary, 8 Pilgrim Rd., Waban MA 02168

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Our class was well represented at Technology Day. President "**Chink**" **Drew** and Lillian came down from Portsmouth, N.H., and joined **Will Gardiner**, **Jim Howard**, **Ed McLaughlin**, **Francis Mulcahy**, **Milt Salzman**, **Sam Spiker** and yours truly. Planning for the reunion in 1980 is in good hands. Will Gardiner, Jim Howard and **Ed Kussmaul** with

Courtney Worthington as chairman constitute the committee. They will be glad to receive suggestions from classmates.

A number of notes have reached me by way of the Alumni Fund Office and I pass them on to you. **Roger Ward** our world traveller writes from Florida that he fears old age is beginning to catch up with him so that he will have to stay in the U.S. this summer. . . . **Mary Tripp** is still working to help send three grandchildren through college, having already finished with four. She hopes to make the 55th Reunion in 1980. . . . **Harry B. Smith** says he has an ideal retirement racket, working at C.T. Main, Engineers during the winter and playing with his toys (sailboats, etc.) during the summer at his home in Winter Harbor, Maine. He sends best wishes to classmates. . . . **Fred Greer** reports he was still enjoying good Florida weather in early May. He has recently become a legal resident of Florida although New London, N.H., still looks good to him from May 15 to October 15. **Alan Crowell** brings us up to date reporting the death of his wife of 48 years in 1978. New news is that on May 23 he married a long-time friend Katharine W. Pond. The wedding was at St. Andrews Episcopal Church in Longmeadow, Mass. They will be at home at 2449 Valencia Dr., Sarasota, Fla., after October 1.

Anthony Tsongas reports that he and his wife spent a month travelling through Greece a year ago. The highlight of the trip was attendance at the wedding of a niece in the high mountains of Pindos where 1000-year-old customs are still observed. They also took a cruise visiting the islands of Mykonos, Rhodes, Crete, and Santorine. . . . **Arthur "Gus" Hall** simply reports that he is looking forward to the 55th.

All news is not pleasant. **Franklin Fricker's** wife Dorothy died suddenly a few weeks ago. I am sure this will be a shock to many classmates, particularly those who enjoyed the Frickers at our 50th Reunion. . . . **Josiah Crosby**, '21, Secretary of the M.I.T. Club of Southwest Florida provided the following information. **Benjamin E. Beale** died at Memorial Hospital in Sarasota, Fla., on April 23, 1979. Ben was born in Somerville, Mass., and was director of research for Joanna Western Mills, Inc., in Chicago and lived in Hinsdale, Ill., for 30 years before moving to Sarasota. He was past commodore of the Sarasota Yacht Club, treasurer of the Florida Council of Yacht Clubs and member of Blue Gavel and of the U.S. Power Squadron. He leaves his wife, Mary, two sons, a sister and six grandchildren.

A letter from Mrs. **Donald F. Yakely** informed me of the death of her husband at Armonk, N.Y. on April 7, 1979. She was kind enough to provide the following information: "Don had worked for a while with Bankers Trust Company and Equitable Life, both in New York. However, he spent a good part of his life in U.S. Government service. He was with the National Recovery Administration during the Depression. During and after World War II, he was with the Renegotiation Board. When he retired, in 1969, he was in the Court Defense Division of Internal Revenue Service. In all of these positions, he was a financial analyst, with the emphasis on analyzing the financial condition of industrial corporations." The Alumni Records Office has received notice of the death of **Frederick S. Brown** in Waltham, Mass., on May 9, 1979 — **F. Leroy (Doc) Foster**, Secretary, 434 Old Corners Road, P.O. Box 331, North Chatham, MA 02650.

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Your secretary has learned how to smoke out an "unheard from" classmate. Report him dead! This is our second offense, and of course each time it was a mistake based upon "bona fide" information we had received. In each case the "victim" accepted his fate with aplomb and we are still friends. The latest "resurrection" is **Bob Glidden** who writes: "I had a phone call several days ago, and a letter yesterday from **Johnny Longyear**, who reported he had seen mention of my 'death' in the *Technology Review*! This is news to me, as so far as I know, I am still perking up here in

Maine. At least the guy I look at in the mirror every morning when I am shaving still looks like me! Probably it's like Mark Twain's comment — 'The report of my death is greatly exaggerated!' Anyway, since my retirement in 1967 we have been living here in Camden. I would guess there are two possibilities which led your informers to conclude I had kicked the bucket. The first is the death of our youngest son in Vietnam in 1967. He was Captain Richard C. Glidden and although the names are not the same, there is similarity enough to cause confusion between him and me. The other possibility is that my wife and I customarily go away for two or three months in the winter, and we always have our telephone temporarily disconnected in our absence. I hope things are going well with you, Smitty, and that you are enjoying your retirement. We both love it — it's the frosting on the cake!"

Thanks, Bob, for your understanding. We are sure glad to have you back on the rolls! If the gas shortage were not so scary, you would probably have many '26 classmates pounding on your door this summer.

Our class cantor **Morris Minsk** phoned from Washington the day before Alumni Day to express his regrets at not being able to attend this year. Morris followed his call with a letter explaining his trips between Washington and Chelsea to visit his sister every few months. Your secretary ventured to Cambridge for the Alumni Day luncheon only — it being our first time out of Cape Ann. The class had excellent representation for an off year. It was announced that **James Killian** is returning as honorary chairman of the Corporation. Jim and Liz were both with our group and are both fine. Other classmates at the two tables were Ruth and **Benny Margolin**, Evelyn and **Bob Dawes**, the **Harvey Abbotts**, the **Jack Larkins**, and the **Don Cunninghams**. Don has since written us a note: "I am enclosing a copy of the letter I just received from Ruth Wilson. I will write to her, Yesterday I was at M.I.T. telephoning regarding the Alumni Fund. I had **Dick Whiting's** name so called and had a nice chat with him. He is still playing his drums, still practicing law, and busy with several volunteer programs. He is also playing a small part in a movie to be released in October called 'Starting Over!'"

"**Deke**" **Nason** has taken no chance of unfounded rumors circulating concerning his whereabouts and writes from Riverside, Ill. "Same guy — even in weight — same place (27 years). Survivor of three successive tough winters. Bowling season ends this month. Golf starts (for me) in May."

The following is factual. We regret to report the death of **Anthony P. Gabrenas** in August, 1977. "Tony" was considerably older than the rest of us and had been failing in recent years. He was one of the most devoted members of the class, never missed a reunion and regularly wrote of his activities. A few years ago your secretary drove from the Miami airport to Key Largo for some sailing and hunted Tony up at his home in South Miami for a pleasant half hour that now becomes memorable.

Speaking of sailing, today is our first race and we plan to give it a try. It has always been excellent therapy, so with the aid of a hale 30-year-old crew we look forward to the beginning of the season. We hope that you have had a pleasant summer and that you will write us about it. Cheerio until fall! — **George Warren Smith**, Secretary, P.O. Box 506, Pigeon Cove, MA 01966

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"The biggest news this month, and also the saddest — **Jim Lyles** is gone after a heroic struggle for 15 years. The struggle has been an inspiration to all of us. Whatever our own adversities, we could always look to Jim and Molly Lyles for leadership."

These words were written today by **Joe Melhado**, my father-in-law, who is in the hospital courageously waging his own battle against cancer. He wasn't able to meet his deadline from his hospital bed without a little help from me. It's a

pleasure to be able to help a man who has helped me with kindness and advice for the last 18 years.

Jim Lyles died in early June at the age of 75. In writing to my father-in-law, Molly Lyles said, "Jim was a stalwart with his incapacities, for over 15 years, and a loyal son and graduate of M.I.T. Returning to his 50th reunion was a major accomplishment and a great joy for him and for me. It was a happy, proud landmark in our lives."

Molly also sent a clipping from the *Lakeview Journal*, a paper in Canaan, Conn. We thought you'd like to read a tribute paid to Jim by Lawrence Eddy, Jim's cousin:

"What a man! To those of us who were privileged to know him from boyhood to his mature years, he was indeed an inspiration."

"His keen and active mind led him to participate in an unbelievably wide range of interests. . . . He became an ardent railroad buff and a lover and collector of antiques, particularly tools and utensils of early American vintage. Of more serious import were his contributions of time and talent to various organizations . . . such as Lawrence Hospital, Sarah Lawrence College, Berkshire School, the Falls Village-Canaan Historical Society and others."

"In his later years, in spite of his infirmities and personal sorrows, his cheerful grin and firm handshake has indeed been a tremendous inspiration to his many friends. . . . The real source of Jim's cheerfulness was his innate courage, and that originated in his own character. Again, I say — What a man!"

Joe Melhado was the guest of honor on June 10 at a party given for supporters of the Westchester Symphony Orchestra. Harold Taylor, an orchestra member and supporter, said of Joe: "If anyone deserves to be called 'Mr. Westchester Symphony,' it is certainly **Joe Melhado**. In 1965 when a merger was completed that saved the orchestra, it was a musical triumph, but those of us who had gone through those months of hard work knew that it was also a triumph for **Joe Melhado's** remarkable leadership. Without exception, every Westchester Symphony president since then has regarded Joe as something akin to a national treasure."

"When a difficult decision has had to be made, Joe's wise, patient counsel has been available. When an important letter required the touch of a master letter-writer, it is usually Joe who has been called upon to write it. When a board meeting has been held up by the wording for a complicated motion, it is frequently Joe who has phrased it so that it can be understood by anyone who reads it — two weeks from now or ten years from now."

"He is even more remarkable now . . . and I hope he won't mind my telling you this. He said that he could allow what has happened to him to destroy him . . . but instead he chooses to accept it as a challenge. That is a man . . . and that is Joe."

Reports from other classmates across the country:

Walt Walker writes, "Having survived the Tenneco-U.S. Steelworkers' strike at Newport News Shipbuilding, the nuclear plant disaster at Three Rivers, the Iran Caper, my wife and myself have much to thankful for. We are now looking forward to — through the good ministrations of the 'Great White Father in Washington' — an even more eventful and prosperous 1979-80. Does any of my former classmates know where I might obtain a good used bicycle at a rock-bottom price? So — what else is new?"

Just before departure, **George H. Jenkins** sent this note: "I'm off to Britain again, May 30 to July 8, to see many of my 50-plus English cousins whose ages run from 5 to 82!"

John P. Vinti reports that he is keeping busy lecturing at M.I.T. in the Aero-Astro Department.

"My 17-year-old grandson," reports **Laurence B. Cheney**, "has just been accepted for admission to M.I.T. as well as CalTech and Yale. He's a bright lad, finished high school in three years, was valedictorian, and was invited to teach at Talcott Mountain Science Center near Hartford. I've been passing along to him all my *Tech Reviews* for several years and believe he prefers to go to M.I.T. He should be good material for a scientific

career."

Lee Miller writes, "My wife and I are enjoying good health on our 50-acre tree farm in beautiful southern Ohio. We still grow Christmas trees, primarily as a hobby, but they do support our farm."

"Since retirement in 1974," reports **Thomas J. Scott**, "I have been making foreign trips about once a year, the latest being to Guatemala to visit the Mayan ruins at Tikal and other places."

From South Carolina, **Charlie Hurkamp** writes: "I retired in 1971 and am living at Hilton Head Island. I am still active in product development, having developed a series of boxes and shipping containers which can be folded flat for return shipment."

Elmer (Andy) Andrews reports that he retired in 1967 from Eastman Kodak after 40 years of service — mostly engineering and administrative. He has two sons — one has his own business in Columbus, Ohio, and the other one is in engineering administration at Eastman Kodak. He is very interested in traveling and is doing a great deal of it. — **Ruth Melhado** for **Joseph H. Melhado**, Secretary, 24 Rodney Road, Scarsdale, NY 10583

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Charlie Worthen wrote to say that he and Velma would start their trip by car to California (and their new home) on June 15. Says Charlie, "Our children and other relatives live in California now and it seems desirable to be near them. We shall be in a retirement community on the outskirts of San Jose. We leave our many friends in Little Compton and the Boston areas with considerable regret but it seems the sensible thing to do." Any of you who wish to have Charlie's immediate and ultimate addresses can have the information by writing to your secretary.

Aleck Tsongas sent this brief message: "Thanks to all the 1928 classmates whom Bertha and I urged to help my nephew Paul Tsongas win his Senate race." . . . **Gerry MacGillivray** reports a personal mishap that landed him in the hospital last winter. Apparently he is all right now and attributes his resiliency to Scottish genes. Gerry says also that he had a letter from **Tom Larson** in Florida and that Tom was working as a "big wheel" for one of the golf tournaments. . . . **Judith (Mrs. Benjamin F.) Miller** is planning to present some of Ben's writings and memorabilia to the M.I.T. Historical Collections. . . . Just recently **Herm Jones** sent in an item for the Historical Collections. It was one of several Tech banners that **George Mangurian** had obtained in 1926 for use at camp in Maine.

Frank Taylor tells us something of his activities in this note: "As an avocation I have been working with a group of young people dedicated to establishing a museum of the urban and neighborhood history of the city of Washington. We are completing our first exhibition and are making progress on the legislative path through the D.C. Council. It takes a fair share of time and work." . . . **Jim Donovan** has been in contact with several classmates. **Tom Garrard** has a common interest with Jim in certain books and wishes he could find more time to do all the reading he would like. It appears that Tom and Allece are both in good health. . . . Jim has heard also from **Jay Monier**. Jay has had some health problems but apparently does well enough if he is careful — even plays some golf.

Florence and your secretary represented the Class at commencement exercises in June. It was a pleasant and impressive event in spite of a little rain shower. The spirit of hope and enthusiasm that fills such an occasion is definitely contagious. Technology Day activities were attended by the following classmates: **Mortimer Budlong**, **Jim Donovan**, **Fred Lewis**, **Mary Nichols**, **Al Puschin**, **Walter Smith**, **Florence Smith**, **Will Tibbetts** and **Frank Taylor**. Unfortunately, we do not have a list of the attending spouses but believe that several were there.

With deep regret we must report the deaths of four classmates. **Gilbert J. Ackerman** died on April 8. Gil had been in good health until shortly

before then. We talked with his wife, Frances, who said they had enjoyed a very pleasant fiftieth wedding anniversary only a few months earlier. Also she was glad they had been able to attend the 50th Class Reunion last June. Gil was retired but had been in the shipping industry and in the construction business during his professional years. Gil had two daughters and four grandchildren. . . . **R. Preston Carter** died on April 24. In a telephone conversation with his wife, we learned that Pres had been well and active almost to the day of his death. His entire professional career was with Aluminum Company of America. He retired in 1966 after 38 years of service. Pres had two daughters. . . . **Norman L. Fournier** died at home on March 22, as a result of a brain tumor. He had been ill for a long time. Norman served in various government and industrial positions before entering the Department of Health and Mental Hygiene, Health Planning, for the State of Maryland. He was retired from this last office. Norman's wife, Janet, wrote to inform us of his passing and she gave the names of his children: Susan, David, Eric and Lauren and his son Dean by a previous marriage. . . . **Edward M. Shiepe** died of a heart attack at home on April 23. In writing to us, wife Josephine said that the happy memories of the Reunion last June had sustained Ed in his final illness and were also a comfort to her in her sorrow. For most of his professional life Ed worked in the radio communication manufacturing field. In what he called a "diversion" Ed also masterminded the design and construction of a principal exhibit in the New York World's Fair of 1939. To each of the families we extend our heartfelt sympathy. — **Walter J. Smith**, Secretary, 37 Dix St., Winchester, MA 01890

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At Chatham, quite a number of you asked me why there were no class notes in the May issue, just before the 50th Reunion. It wasn't deliberate, to be sure! Our notes reached the *Technology Review* offices in time, but were inadvertently left out when the magazine was assembled. All's well that ends well, though — we are including in this issue all the news you missed in May.

Our 50th Reunion was a spectacular success in every respect. We all owe gratitude to **Jim Fahey**, the general chairman, and his man Friday **Jerry Gardner** who coordinated all the activities both at Chatham and on campus with a "Swiss watch" precision. Approximately 80 members attended, most with their spouses. Most of those who came to Chatham arrived Monday afternoon, June 4, for an informal get-together and a dinner at night. Your secretary had the pleasure of having **Hunter Rouse** and his wife **Doi** and **Larry Moses** as traveling companions from Boston to Chatham and back to campus. The Rouses arrived Sunday evening at Logan; Monday morning, we picked up Larry and had a pleasant and leisurely ride to Chatham. Upon our arrival at Chatham Bars Inn, our group was assigned to cottage No. 6. The first person that I encountered was **Laurence D. Luey** from Birmingham, Ala., who is a friend of **Amasa (Mace) Smith** of the same city. Mace had sent his regrets for his inability to attend. Others in the cottage No. 6 were: **Marion and Robert S. Pride**, **Helen and Neal Wells**, **Doi and Hunter Rouse**, **Dorothy and Sears L. Hallett**, and **Helen and your secretary**. In our conversations, we discovered that **Sears's** sister is married to one of my attorneys in Arlington and my wife **Helen** was a volunteer with her in Symmes Hospital for many years.

Tuesday was the big day at Chatham: our banquet. We were honored by the presence of **Howard Johnson** (chairman, M.I.T. Corporation) with his lovely wife and **Don Severance** and his equally lovely wife. The Severances, if not officially, are known as honorary members of Class of 1929, and have attended at least the past three major reunions to my knowledge. As expected, **Howard Johnson** was the main speaker; he gave us a progress report on the growth of M.I.T. in general and the status of the five-year Leadership Campaign, the general goal of which was to raise

\$225 million dollars by 1980. He informed us that over \$210 million dollars has already been raised in the past four years. He also observed how well our class members have done in spite of our misfortune to be known as the "Depression Class."

Frank Mead, chairman of the 50th Reunion Class Gift, gave a progress report on the gift. Five years ago, when Frank was designated chairman, he had set a goal of one million dollars to present to M.I.T. on Technology Day — and he was disappointed to report that we had not quite achieved our goal, as we had raised approximately \$937,000 to date. He concluded that it wasn't bad but could have been better. Just then, **John Wilson**, chairman of estate gifts, got up and said, "Frank, I am sorry I did not have a chance to tell you this until now. A member of our class has just donated \$50,000, which will help to achieve our goal." Tremendous applause greeted this announcement. Frank said, "That makes me feel elated, but any of you fellows who have not participated in pledging, or would like to increase your pledge and/or giving, see me in the lobby after dinner." Later Frank received a number of generous contributions which pushed the total up to approximately \$1,071,000 and thus realized our goal of a million-dollar 50th Reunion gift. Frank also informed us that 66 per cent of our class members participated, and our 50th Reunion gift is the third largest given to M.I.T. to date.

At the conclusion of the banquet, a short business meeting was called by **Bill Baumrucker**, president of our class. **Virgil (Dan) W. McDaniel**, chairman of the nominating committee, presented the following members to be nominated for class officers for the next five years: **W. Gordon (Bill) Bowie**, president; **Hunter Rouse**, vice president; **Malcolm M. (Mac) Hubbard**, to be reelected as treasurer; **Karnig S. Dinjian**, to be reelected as secretary; **Jim Fahey**, class agent. The slate of officers was nominated and elected unanimously by a voice vote.

Wednesday, we were treated to cocktails and to a real New England clam-bake — lobsters, clams, and corn — steam-cooked in seaweed. Just before the clam-bake, our cottage held a mini "happy hour." In the evening, we saw **Neal Wells's** slides of past reunions and your secretary's movies of the 40th and 45th Reunions. There were all the usual activities — golfing, fishing, tours, shopping and such. Quite a number of our class members remarked how much more they enjoyed the 50th Reunion compared with others. All activities were conducted in a relaxed atmosphere.

On Thursday, we headed for the plush Hyatt Regency Hotel next to the M.I.T. campus, where we were housed as guests of the Alumni Association for having earned the distinction of wearing the cardinal blazer with the Institute's seal. At 5 o'clock, shuttle busses under the supervision of **Jerry Gardner** started to take our members to President Wiesner's house for scheduled cocktails and a hot buffet. Jerry did the impossible, providing bus service for even the last stragglers. At the president's cocktail party, a number of people asked me if I had seen **Bill Slagle**. When I informed that I was not acquainted with him, the response was "What! You don't know Bill Slagle?" I finally met Bill, who lives on almost the same street as ours in Arlington, and his wife **Ellen** who worked as a volunteer at Symmes Hospital with my wife **Helen**. The reason I never knew Bill lived near us is that on my list of classmates I had his business address in Boston, and the "dumb computer" did not reveal his home address, so close to ours.

At about 7:45 p.m., buses took all of us to Symphony Hall for the traditional "Tech Night" at Pops. We were disappointed not to have **Arthur Fiedler** conducting, but both the substitute conductor and the program were excellent. My wife and I had the pleasure of sharing the same table with Professor **Herman (Fritz) P. Meissner** and his wife **Dorothy**. We mentioned that a number of our members were curious how many were in our graduating class and how many are still alive, and "Fritz" volunteered to call the alumni office to get the information. Once again the "dumb computer"

came up with an unusual answer: graduating class with S.B. degrees, 482 — still living, 487.

On Friday, the Alumni Association treated our class to a continental breakfast followed by an interesting program at Rockwell Cage. At 12:30, all classes gathered at duPont Court for the usual luncheon and presentation of class gifts. After the 25th and 40th Reunions were presented, **Bill Baumrucker** went to the podium and introduced **Frank Mead**, our gift chairman, who made the presentation of the 50th Reunion gift — over one million dollars — third largest gift in that category to date. He also stated that approximately one additional million dollars have been pledged through wills and estates.

Thus ended our 50th Reunion. Space does not permit to list all who attended, but the material submitted by members will be in class news in future issues. Classmates who have attended five or more of the past ten reunions: **Bill Aldrich** (5), **Bill Bowie** (6), **Ralph H. Crosby** (5), **Karnig S. Dinjian** (5), **Wally Gale** (8), **Jerry Gardner** (7), **Joe Green** (9), **Sears L. Hallett** (6), **John F. Joyce** (6), **Virgil (Dan) McDaniel** (6), **Frank Mead** (6), **Herman (Fritz) Meissner** (7), **Al Moore** (5), **Leonard C. Peskin** (5), **John P. Rich** (6), **Bill Shannon** (5), **Thomas H. Speller** (6), and **Bill Young** (6). Those who traveled 1,000 miles or more to attend: **Earl H. Abbe**, Fla., **Bill Aldrich**, Mont., **J. Russell Clark**, Tex., **Arnold Contil**, Fla., **Stephen Dilworth**, Fla., **Earl Erickson**, Calif., **Laurence D. Luey**, Ala., **John D. McCaskey**, Mont., **Larry Moses**, Fla., **Hunter Rouse**, Ariz., **Wade H. Shorter**, Calif., **Morris Smith**, Israel, **Louis F. Southerland**, Tex., **Nick Stathis**, Fla., **Gus Stein**, Fla., **Neal Wells**, Fla.

Oliver K. Noji writes, "When I returned home from a trip, I found your birthday greetings which I appreciate and thank you for it. Fifty years isn't so long; neither is my 75th birthday, historically speaking. I met my wife in a camp near Watch Tower, surrounded by barbed wire, in 1943. When freedom came, Chicago gave me a new life and renewed love for America. I received my citizenship and became eligible for my architect's license. Retirement has been fun, doing some traveling, visiting Japan and Mexico. I do water-color painting as a hobby." Oliver also sent me a cartoon with the caption **FINALLY — I QUIT!**, with his drafting table in disarray in the background, and papers scattered around his room. It proves that "a picture is worth 1000 words."

Modesty is a rare commodity these days, but **Heinn F. Tomfohrde, Jr.** seems to have it. He would like his classmates to know that it was his son, **Heinn III**, not him, mentioned in an article in the *Review*, who distinguished himself professionally as division president of Union Carbide. **Heinn, Jr.** has not done badly either. He has had a distinguished career with Getty Oil Co. in the field of manufacturing, transportation and finance, retiring in 1971. He continued doing consulting work for four additional years before he quit for good. He is active in civic affairs and does some traveling, taking cruises and motor tours around the country.

Kenneth L. Horgan's wife called to say that her husband was too ill to attend the 50th Reunion, which he wanted so badly to do. He sent his greetings to all his lucky classmates who were able to attend, especially Captain **James B. Magenis** and **Joaquin J. Llanos**. It'd be nice to send him a "Get Well" card; the address is 9081 Thunderbird Dr., Coral Spring, Fla. 33056. . . . The widow of **Harcourt C. Vernal**, announcing her husband's death, stated that his current address is "Heaven" and his job is "Engineer" for Saint Peter. He wanted to attend the 50th Reunion so much that he was counting the years and months to the Big Event.

G. Ridgley McDaniel writes, "While attending the Unitarian Universalist General Assembly meeting last June in Boston University, I had an opportunity one evening to visit M.I.T., to walk through the halls and some of the campus after so many years. Just 50 years ago, I was spending my last month at M.I.T. — so it was a real thrill and wonderful experience to be there again. To record the occasion, a fellow alumnus took my picture in the duPont Court with the great dome in the

background. I shall always be grateful for what M.I.T. did for me during my undergraduate days."

Daniel J. O'Connell was the recipient of the United Way's Alice K. Lucey Volunteerism Award at its annual meeting held in the Yankee Pedlar Inn in Holyoke, Mass. **Philip R. Ryan**, the past president of United Way, read the citation: "It is particularly fitting in this, the 100th anniversary of Daniel O'Connell Sons, Inc., that you receive recognition for your unselfish dedication to the greater Holyoke community." Dan's reply was, "I am a better person because of the hours I put into the United Way. As is true in all such cases, when you put effort into something worthwhile, you get much more in return." . . . **Oscar Aros-Villa** of Mexico writes, "I am having a good time as a 75-year-old retired engineer. I went abroad last year and lived in Spain for a year at Algorta Vizcaya. In 1970, I went to Europe, visiting Portugal, Spain, Italy, Switzerland, France, Belgium, England, and Luxembourg."

Emery M. Low has retired as chief mechanical engineer of the American Totalisator Co. as of June, 1977, but continues doing consulting work for the same company and its affiliates, as well as the International Computing Co. and the U.S. State Department Passport Division. He will be going to San Francisco in December with his wife Lois to hear their son, **Emery II** ('64), deliver a paper at the A.S.M.E. Annual Meeting. . . . **Mirko Paneyko** of Fairfield, Conn., is still active as president and chief engineer of M.P. Audio Corp., designing and manufacturing probably the best record and tape players in the market (according to him). Their product is sold directly to homes, schools, colleges and public libraries. His hobbies are tennis and boating.

A note sent to the Alumni Fund by **J. Henry L. Giles** reads, "Since this is my 50th Reunion year, I would like to contribute as much as I can. With business improving, I may increase my pledge." Henry retired a few years ago from his sanitary engineering profession and currently is running a guest house for the elderly (range of ages from 84 to 95) — himself a young 71. . . . **John D. McCaskey** says, "As an unemployed person, I spend about 107 hours per week for necessary things, which leaves me 61 hours for sleep, fun and games."

Nathan E. Promisel was the recipient of an honorary "Doctor of Engineering" degree from Michigan Technological University last fall and gave the commencement address to the graduating class. . . . **Henry A. Ambrose** has just retired as director of new products division of Gulf Research and Development Co., subsidiary of Gulf Oil Corp. . . . **Nick Stathis** sends a brief note, saying, "I am increasing my gift to the Alumni Fund in celebration of the 50th anniversary of my graduation from M.I.T.!"

Warren W. Walker who has had a distinguished industrial career running the Graphite Corp. in Yonkers, N.Y., is also enjoying a reflected glory in the achievements of other members of his family. His son, **Eben** ('69) was recently promoted to vice president of Citibank N.Y., the second largest bank in the country. His son-in-law, **Richard Miksad**, Sc.D. '70, was appointed associate professor in the Mechanical Engineering Department of the University of Texas. Besides keeping a watchful eye on his Graphite Corp., he devotes time to civic and industrial problems of Yonkers. He was recently appointed to C.O.P.E. (Commission on Productivity and Effectiveness), an eleven-man team of professional and business leaders trying to help the City of Yonkers solve its fiscal problems. He is also the executive director of the American Association of Industrial Management (Yonkers Branch) which he nurtured from a debt-ridden and inefficient organization to a viable, self-supporting one. He contributes economic analyses to the Association's periodical.

Harold W. Straat has retired from Bausch and Lomb as of 1972, but does consulting for the same firm as a senior scientist. "We are all in excellent health," he writes, "and keeping busy. Our oldest daughter, **Patricia**, is a director of research in Biospherics; while our other daughter, **Ginny**, is an art teacher and does beautiful water-color paintings which she sells. The grandchildren

are just as talented. So, you see, there is nothing 'new' with us, but just 'steady' as she goes." . . . A note from **Harold M. Weddle** states that on December 6 he went to a doctor for a routine physical check-up, but before the day was over, it was found that he had a congestive heart failure. He had no idea there was anything wrong with his heart. He was moved into another hospital for more tests, followed by open-heart surgery, including aortic valve and two by-passes. In spite of the gravity of the surgery, Harold must have been in tip-top condition aside from his heart problem: he was sent home after eight days with a special diet of no fat, no sugar and no salt. He lost over 40 pounds in the process. "Other than being a little weak, I feel fine. Now I am taking two 30-minute walks per day."

I regret to report that three of our members have passed on: **Norman V. Ballou** of Dublin, N.H., in January, 1977; **Gus Colarusso** of Boston, on January 10, 1979; and **Leonard Stievater, Jr.** of New Smyrna Beach, Fla., on August 31, 1977. — **Karnig S. Dinjian**, Secretary, 10 Ancient Highway at Plaice Cove, Hampton, NH 03842, (603) 926-5363; also P.O. Box 83, Arlington, MA 02174, (617) 643-8364

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The most extensive communication that arrived during the last month comes from **Win Hartford** who is living in Charlotte, N.C. As previously reported in the Notes, after retiring from Allied Chemical in 1969 Win acquired a teaching job at Belmont Abbey College where he has recently been given emeritus status (although he plans to continue teaching there for another year). Win's specialty is environmental science in which he appears to have been cutting quite a swath in the Charlotte area. About seven years ago he started an environmental science course and curriculum at Belmont Abbey which he says was "built on nothing less than good old chemical thermodynamics" and has given him "a soap box from which I can bring my students into the community and study problems at first-hand." Win also writes for the *Charlotte Observer* and *News* on environmental topics, serves on a couple of citizens' committees and as a result of these activities has recently been named one of eight outstanding seniors in Mecklenburg County for 1979. Other chores that keep him occupied are as correspondent for the periodicals *Chemical and Engineering News*, *Chemtech*, and *Environment*, and authorship of a chapter in Kirk-Othmer's *Encyclopedia of Chemical Technology*. Another kudos that he has received is the 1979 Award of Merit of the American Wood Preservers' Association. As if this weren't enough, he is currently playing the part of Merlyn in a Little Theatre production of Camelot which he characterizes as a "good role for a Tech man." There appears to be little doubt that Win is one of our most active classmates.

Lester Meyer is still living in Alton, Ill., and has continued doing a certain amount of work with Sheppard, Morgan and Schwaab, Inc., civil engineers and surveyors. He is treasurer of the Alton area Historical Society and is involved with a Little Theater group "in a non-theatrical capacity only." . . . **Jean Kresser** is still active as a power systems consultant, presently working on projects in California, Hawaii and Peru. . . . **Howard Gardner** is retiring from his professorship at the University of Washington as of June 1979. He and Teddy will move during the summer to Laguna Hills, Calif., "where we hope the climate will be easy on sinuses and allergies."

Manny Birnbaum was installed as a university fellow at the spring convocation of the University of Guelph, Ontario. After the installation ceremony he delivered an address entitled "Each Person Is a Universe" to the students receiving graduate degrees. In general, he dealt with the problem of how a university can be financed without politicizing it. Manny was a member of the university's first Board of Governors and is a past chairman of the Board. In recent years he and Madelyn have spent winters at their home on Longboat Key near Sarasota and summers in or near Guelph.

It is regrettably necessary to report that several more of our classmates have died. These include a delayed report that **Malcolm Bruce** died on October 5, 1970. The only other information about him in my records is that he was living in Plymouth, Mass., at the time of his death. . . . **Sam Koren**, who was one of our five patent examiners, died on March 13, 1979. Again, the only additional fact that I have at hand is that he was living in Silver Spring, Md., at the time of his death. According to my records **Jack Bloom** died several years ago and the surviving examiners (all I believe retired) are **Tom Hickey**, **Jim Keeley** and our faithful "re-uner" **Bill Wye**. . . . In the case of **Lauri Lindell** who died on March 15, 1979, somewhat more information is available. Lauri was born in Finland and came to the United States in 1920. After graduating with our class Lauri acquired a Bachelor of Arts degree from Harvard and practiced architecture in Pittsburgh and Boston. About eight years ago, he retired as an architect with the federal General Services Administration, and continued to live in Lexington, Mass., where he was active in various civic affairs. He was a former town meeting member and former chairman of the United Way in Lexington, as well as a member of the Simon W. Robinson Masonic Lodge and the Hancock Church Men's Club. He was also president of the Finlandia Foundation of Boston. He is survived by his wife Ellen, two daughters and three grandchildren. — **Gordon K. Lister**, Secretary, 530 Fifth Ave., New York, NY 10036

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Arnold Childs reports that they spend six months in Siesta Key, Fla., and six months in Thornton, N.H., where they have five guest cottages. Their older son Ronald is an ordained minister and teaches and does missionary work in Nigeria with his wife and three children. The younger son is with Metropolitan Life in New York and lives in Rye, N.Y., with his wife and 2 children. . . . Enjoyed a letter from **Randy Binner** and his wife Hope telling how much they enjoyed the mini-reunion in Bermuda. It certainly was a grand success with about 20 classmates and their wives attending. Polly and **Ken Germeshausen** surely did an outstanding job. . . . **A. Harry Wagner** retired in 1974 but I'm not sure from the notes whether he is or was president and chairman of the board of Southern Brick Contractors, Inc., Richmond, Va. . . . A note from the Alumni Association tells that **John R. Gardner** retired from General Electric but gives no additional information.

The saddest part of being a Class Secretary is the duty to report the deaths of our classmates. This month, word has been received that Lieutenant-Colonel **Arnold Boogher** died on March 8, 1979; **Leland E. Gibbs** passed away on April 30, 1979. Leland was past president of the Westmoreland Board of Education and a retired employee of Revere Copper and Brass Co., where he was a metallurgist and provided technical advisory services until his retirement in 1974. Survivors include his wife, Mary Marks Gibbs, daughters Mrs. Harold Black and Mrs. Joseph Racioppi, son Randolph A. Marks, sister Mrs. Roland Studley, and 14 grandchildren. Death notices were also received for **William H. Harig, Jr.**, who died February 21, 1979, and **Francis A. Gregory** on February 27, 1977. Our sincere sympathy to all of their families. — **Edwin S. Worden**, Secretary, P.O. Box 1241, Mount Dora, FL 32757; **Ben Steverman**, Assistant Secretary, 3 Pawtucket Rd., Plymouth, MA 02360; **John R. Swanton**, Assistant Secretary, 27 George St., Newton, MA 02158

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Our class was very well represented on Alumni Day, June 8 at M.I.T. The following were in attendance: **James D. Abbott**, **Wendall E. Bearce**, **John J. Brown**, **Melvin Castleman**, **George R. Daniels**, **Francis T. Gowen**, **Dick Heidtmann**, **Harry L. Johnson**, **Bill Pearce**, **Don Brookfield**, **Charles H. Taylor**, **Thomas Weston**, and **John D.**

Northup. It was a beautiful June day, the program most interesting — and a chance to renew friendships and gather material for at least two issues of *Technology Review*.

A most impressive memorial service for M.I.T. alumni was conducted by Reverend Scott Paradise at the M.I.T. Chapel. Those reported deceased in the last year from the class of 1932 are as follows: **William H. Duffy**, **Alan B. Fisher**, **Howard H. Imray, Jr.**, **Arthur D. Jewell**, **J. Lincoln Moore**, **Robert H. Morris**, **Norman E. Poinier**, **Donald A. Rice**, **Ebed L. Ripley**, **Stanley J. Szymczyk**, and **Harold F. Tonsing**.

James Abbott worked for 20 years with Gillette and retired in November 1976. He now resides in New London, N.H., with his wife Rita. One of his boys lives in Arizona and the other in New Jersey. The Abbotts are active hikers and mountain climbers. James volunteers one day a week for the protection of New Hampshire forests. This organization was formed in 1901 to stem the ruthless harvesting of forests. These efforts culminated in the establishment of the White Mountain National Forest. Today a small permanent staff and many volunteers carry on this important work in innumerable ways.

John J. Brown is more or less retired. He was assigned a consulting project in London during March. At the time he was anticipating a three-week vacation in Europe, mainly in Ireland. John called to my attention a most interesting write up on **Lawrence Berk**, President of Berklee Performance Center, a unique and internationally recognized school of music in Boston. It has 2,700 students today. While studying architectural engineering Larry was a moonlighting pianist for the leading orchestra in the Boston area. Recently his son hosted a 70th birthday party for him and before the evening was over, Larry sat at the piano and "played for his supper" — as in the old days. Maybe we can get him for our 50th Reunion!

Minot R. Bridgman brought to my attention the obituary of **Robert D. McGilvra**, 68, of Princeton, N.J. He was President of Brann & Stuart Co. and also of R.D. McGilvra Co. He was active in church life. Surviving are his wife, Allison; a daughter Melanie Zador; a son Douglas of Cambridge, Mass.

All for now. I wonder how many will participate in the class golf tournament. — **Melvin Castleman**, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Banner headlines this time 'round are for **Ralph E. Cross**, chairman of the Cross and Trecker Corp., Fraser, Mich., who was awarded the Gold Ceremonial Medallion emblematic of the Society of Manufacturing Engineers on April 30th at the Detroit Plaza Hotel. Ralph is a past president of the National Machine Tool Builders Association, and his name is synonymous with an advanced and highly sophisticated automation. Ralph is a native Detroit; he has been with the Cross Corp. since 1932 and in that period the company has expanded its manufacturing operations into Switzerland, Germany, England, and Japan.

Several members of the Class of 1933 50th Reunion Gift Committee **Dayt Clewell** (Chairman), **Cy Hapgood**, **Warren Henderson**, **Ellis Littmann**, **Fred Murphy**, **George Stoll**, **Jim Turner**, **Stan Walters**, and **Westy Westaway** met at M.I.T. on Friday, May 18. One million dollars was set as a tentative goal for our class gift. All gifts from the five years preceding the 50th Reunion (i.e., fund years 1979 through 1983), as well as all pledges received during this period, will be included in our 50th gift. Any gift made to the Alumni Fund, to the Leadership Campaign, or to the Class will be credited. If you're interested in participating in the Reunion Gift effort, let Dayt know. His address is: 34 Driftway Lane, Darien, Conn. 06820.

1933 was well represented on Technology Day, June 8th; **Bill Andrews**, **Bill Baur**, **Clare Farr**, **Bill Barbour**, **Julian Klein**, **John McAleer**, and yours truly. **Linc Ryder** was signed up to attend but did not appear. Since June 8th, we have notes from **Clare Farr** and **Bill Barbour**. Clare announces

that he is retired eight years but has been spending full time in the real estate business. They have visited California and Hawaii in these retirement years. He also enjoys his amateur radio and is pianist for Actor-singers Chorus. Received after Technology Day this note from Bill Barbour: "My life in Boston and Concord has degenerated from M.I.T.-inspired creative engineering and science to the legal, accounting, and tax problems of the day." In short, Bill has retired and is spending more and more time on his ten acres on the Concord River. Bill also flies his Beech Bonanza and tries to keep his instrument proficiency and all the avionics in order. Bill reports that his daughter, Alicia, is in the University of Michigan Graduate School, after having attended both the University of New Hampshire and M.I.T. Daughter Gigi is in Concord Academy. The Barbours would appreciate having any visiting 1933 members drop into their place in Concord.

We have a nice note from Mrs. Carlo Rumazza, who apologizes for not having written us sooner after Carlo's passing and wishes us to know that their residence in Indian Harbor Beach is not in a retirement community, as I stated in the last issue of the *Review*. She gives us rather a long and complete obituary, most of which cannot be used due to lack of space. However, it does appear that Carlo underwent serious heart surgery several years ago and they retired to Florida after this. Again, we regret Carlo's passing and offer our sympathy to his good wife.

A short one from **Carl Swanson** tells us not to apologize for not replying to Christmas cards, but asks us please to accept his. Carl has been sick with the flu, enough to keep him in bed, but has recovered quite completely though still feels weak. He was sure glad to hear that **Bob Forbes** made such a fine recovery from his heart surgery. . . . We have had a couple of messages from **Walt Skees**, both from Barcelona. He quotes **Ellis Littmann** as suggesting that we print his phone number so that classmates visiting Europe may phone him. The number to the operator is "Barcelona 3298543." Walt's Bahama estate is still for long lease at \$500 a month.

We have a nice note from **Cal Mohr**, though not as newsy as usual. He says he had a bit of a scare at the time of the Three Mile Island fiasco, because they live only 15 miles from there. They received offers of housing from Don Diefendorf, Class of 1930, but finally stayed put. Cal says, also, that **George Garcelon**, **Otto Putnam** and **Neil Hopkins** all live in that same general area but he has not heard from them.

We have a few Alumni Fund capsules. From **Bob Crane**: he was enjoying winter, as usual, at his new official residence in Nokomis, Fla. He saw **C. T. Newton** at the annual picnic of the South-west Florida M.I.T. Club in April. That's not surprising since Mr. Newton, too, lives in Nokomis; and three miles away you can see **Bob White** and also my son, Warren, both of whom live in Venice. . . . From **Al Payne**: he is back in shape to play golf, etc., after a heart attack in January. . . . From **Dick Molloy**: "Why retire if you are doing something useful and enjoy it?" He continues: "My only regret is we do not see our five grandchildren more often. We still enjoy our avocations: tennis, painting, historic houses, and being close to the ocean, both in Florida and Maine." . . . A fine capsule from **Bob Dillon**, doubly welcome because Bob writes so seldom. He has been appointed director for the Central West Region of the Carbide Retiree Service Corps; treasurer of the Host Committee for the 1979 Convention of the American Society for Quality Control in Houston; secretary of the Planning Commission and chairman of the Library Board of the City of La Marque. Just think what Bob could do if he used both hands. . . . **Dick Smith** announces that he and Eileen are enjoying retirement in Key Biscayne, Fla. They are fortunate to be in good health and hope to make the 50th Reunion of our Class.

Now comes the sad part of our job as secretary in relaying the information that some of us have passed away. The alumni records office informs us that **Edward L. Lockman, Jr.** of Providence,

R.I., died on March 18th, and from the same source comes notice of the death of **George H. Bartlett** of Scarborough, Maine. George was the owner and operator of the Bartlett Radio Co. in Scarborough and was very active in local and church affairs. He was associated with the Civil Air Patrol and was a Mason. He is survived by his wife, Olive, three sons and two grandchildren.

I was personally shocked to receive early in June a short note from a son of **Fred Aldridge** reporting Fred's passing away on June 2. At the time of his passing, Fred was head of the Dade County Public Health Service, having moved there from Seattle four or five years ago. Fred spent his life in the Public Health Service in many places, including a long time in Seattle, and in India, Libya, and Iran.

As this manuscript is mailed, Leona and I are observing our 56th wedding anniversary, June 30th, with a dozen old friends joining us for the ceremonial cocktails. — **Warren J. Henderson**, Secretary, Fort Rock Farm, Drawer H, Exeter, N.H. 03833

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Our biggest news for this month concerns the 45th Reunion and how well it was enjoyed by those who attended. They totalled something over 130 class members and their spouses (spice?) and to our pleasure, two of the classmates were women and brought their husbands with them. For once we had good weather for the whole time — no rain — and thanks to the assistance provided by the Alumni Association office, everything went like clockwork. At the class meeting on Sunday morning we elected the following officers: President — **Walt Wrigley**; 1st Vice President — **Jim Eder**; 2nd Vice President — **John Hrones** (he's to worry about the Florida contingent). **Larry Stein** stays on as treasurer and I couldn't find anyone to fight me for the secretaryship. The only unfortunate note came as we were breaking up on the 10th. **Charlie Lucke** found that his car had been stolen from the Vassar St. garage (it was finally found in Somerville but we don't know what the damage was) and three other class members had their cars stripped while in the garage. It's too bad an otherwise great time had to end on a sour note for some. Incidentally, the final business of the morning meeting was a unanimous vote instructing all of us to stay around to be available for the 50th!

Now to pick up the backlog, plus some new items. For a while I have suffered from a mental block between **George Fowles**, **George Patch**, and **George Hatch**. I think I have them sorted out — helped by a Fund note from the latter who says, "Both my wife and I are in good health. Since my retirement we try to take at least one trip far from home each year. While at home I usually take a ten-mile daily bike ride and do a lot of work in my garden. In addition, being on the boards of the San Diego Opera Association and Goodwill keeps me busy." Since I know "Benny" Fowles and Beth spend at least part of the year in North Carolina, and George and Helen Patch are living in Maine, I now think I can keep them straight.

A letter from **George Bull** explained why he couldn't get to reunion — it came close to being serious. He wrote, "The last several weeks have been ones of bitter disappointment. In the winter we arranged for a trip to China that would not interfere with my getting to the reunion. We had a pleasant spring and left for China April 30th. On the trip from Seattle to Hong Kong, Mary Elizabeth became very ill and needed a wheel chair on the way to the hotel. The two-day stay in Hong Kong did not provide a recovery and we had to fly back as soon as possible. Her trouble is a serious form of vertigo and her recovery has been quite slow; consequently I did not feel right either in traveling to Boston with her, or in leaving her alone here in Washington. So please give my regrets to all the members of the class who do come." Things seem to have cleared up; two days go I had a telephone call from George asking how the reunion went. I asked about Mary Elizabeth and he told me she now seemed well recovered and they

are starting to plan the China trip again.

I'm sorry to say another classmate who was planning to come to the reunion was not so lucky. I have both a note from his son and an obituary for **Simeon Van T. Jester** who died May 17 in Waldrick, N.J. He had lived there for 32 years, moving there from Jackson Heights, N.Y. He retired in the middle 1970s from Gulf Oil Corp. where he had worked for 25 years as a lubrication engineer. Sim had also owned and operated the Party House stores in Waldrick and Ho-Ho-Kus for 15 years and was a former member of the Waldrick Board of Education. He is survived by his wife Pearl, two sons — Richard, of Los Angeles, and Craig, of Baltimore, and six grandchildren.

Unfortunately, I have two other losses to report that are much less recent. **Fred L. Haas** died in Wyandotte, Mich. in October, 1977; and Professor **C. Sherman Grove, Jr.** passed away in Charlottesville, Va. in February, 1978. I have no other information about these last two, but to their families and the Jesters I would express sympathy from us all.

It was not until I returned from reunion that I received, along with other material, the following note from **Peter Kalustian**. I feel rather embarrassed as he was with us in Cambridge but I did not know of his loss until afterwards. He writes, "My dear wife Clare died quietly in her sleep on July 14, 1978. She did look forward to our very frequent alumni visits to M.I.T. I do not think too much beyond the present. To do so would make it most difficult and result in an even more empty life for me. My daughter will be building her new home next door real soon. Thus she, her husband, and my four- and five-year-old grandchildren will be very close. My son and his wife live about a half an hour away. One cannot stay too morbid with his family around. My international consulting business is very active and lucrative and I plan to continue it. I do a considerable amount of downhill skiing which I enjoy so much. I guess I should really be thankful for all the blessings that have come my way rather than bemoan my loss."

A note a while back from Colonel (Kentucky) **Bill Bentley** says, "Nearly five years after retirement I will finally realize my lifelong ambition of seeing in print a small religious book I authored when it is printed in April, 1979. If interested, call for it at your favorite book store under the title *The SIMPLE Story of the Universe*." Bill adds that his career started with five years at Douglas Aircraft, then eight years as a civilian employee with the Army Air Corps at Wright Field, 14 years as a Management Consultant in Dayton, and finally 12 more years with the U.S. Air Force at Wright Peterson Air Force Base. He and his wife Katy have been married for 36 years and have a daughter in Portland, Ore., and one in Gary, Ind.

I'll wind up with a few of the Alumni Fund notes that have come my way and leave you with a teaser. **Herb Andrews**, who was at the reunion, had written, "Retired and living comfortably in Westfield, N.J. No special activities except a little traveling." Predating his comment in last issue's notes, **John Newbegin** says, "Retired from S.I. Handling June, 1976. Stayed on for two years as a consultant and in June '78 came to ANPA Research Institute as a consultant and design engineer. Hope to stay until '81 when I will be 70 and retire again." Finally, from **Dick Shaw**: "Keeping occupied is no problem — treasurer of the local Red Cross (Mahwah, N.J.), amateur archeologist, active grandfather."

Now for the teaser — watch for next issue's notes. We have a really amazing letter from **Ming Li Loh** who took his master's degree with us in civil engineering. Thanks to the reestablishment of relations with Mainland China he can now get mail out through the Bamboo Curtain and is anxious to pick up his relations with M.I.T. again. He is teaching at the South China Institute of Technology and I want to give you his whole letter. There's not space for it now, but it will lead off the next notes. — **Robert M. Franklin**, Secretary, 620 Satucket Rd. (P.O. Box 1747), Brewster, MA 02631; **George G. Bull**, Assistant Secretary, 4601 N. Park Ave., Apt. 711, Chevy Chase, MD 20015.

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Charlie Piper's letter follows: "Just got off jury duty this week after having served for two months. I was unlucky enough to be picked for a jury on my tenth day out, the last day you need to serve unless you are on a case, and it turned out to be a biggie. If I ever had any doubt about how dishonest the real estate business is in California, I don't any longer. Our case was that of two parties, a husband and wife, working class people who were defrauded in a real estate transaction, the sale of an apartment building that was their life savings. The jury found general damages against one salesman, one broker, an escrow agent and an escrow company. Punitive damages were awarded against all parties.

"As you probably remember from the 40th, I am a stereo photography enthusiast. In Sept. of last year the International Stereoscopic Union held its biennial meeting at University of York, and I decided to attend. I believe the sun came out about 45 minutes on the 6th day we were in York. However it was an interesting meeting because of the diversity of people attending. York is a lot more like a country club than a college. It has duck ponds, covered walkways between buildings, an ultra-modern central hall located in the center of an artificial lake. It is also equipped with bars which open at noon, vending machines for condoms, and a number of other things we did not have at Tech in 1935. Of such is progress made!

"I will be 65 in June. The authorities at T.R.W. assure me I need not retire unless I want to. Also, I have just got a substantial raise, but no promotion in authority. I am still a senior staff engineer in the Digital Development Laboratory. I expect to make occasional trips to the Bay State on the program.

"I make about 4 miles a day of road work, not really jogging, but more like a fast walk up and down the hills of Palos Verdes peninsula, and fully expect to be around for the 50th.

"For the past two or three years my principal new activity has been repairing stereo cameras. First I did it for fun, then for my friends, and finally I began doing it for money. There has not been a new stereo camera made in this country in 20 years so the people who still shoot stereo are hard put to keep a camera in good working condition. It seems everybody I repaired a camera for has a friend. I am really only trying to keep stereo alive. I also write a monthly column for the newsletter of the Stereo Club of Southern California. The Club has sent reprints to people all over this country and some to Europe."

I am sure it will be a shock to you as it was to me when **Bernie Nelson** called me with the news that on May 10th **Rufus Applegate** died of a heart attack in Philadelphia. He had done a tremendous amount of good to M.I.T. and to our Class. He was our Class Estate Chairman and Co-Chairman for our 45th Reunion next June. With his frequent trips in his own plane and less frequent motorcycle trips he added a certain luster which we will surely miss. To his son and daughter goes our deepest sympathy. — **Allan Q. Mowatt**, Secretary, 61 Beaumont Ave., Newtonville, MA 02160

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It is with sadness that I must report to you the death of **John Easton** in the crash of the Downeast Airlines plane near Owl's Head, Maine last May 30. John had retired from the Singer Company several years ago and had been doing some occasional consulting assignments for **Dana Devereux's** company, The Emerson Consultants. He was returning home from an assignment at the time. Dorothy and the family have established at the Institute a memorial financial assistance fund, the John A. Easton, Jr. ('36) Scholarship Fund. Anyone wishing to contribute should send the contribution directly to the Treasurer's Office at M.I.T. I have written to Dorothy in behalf of the class but in case you wish to write to her the address is Route 131, Tenants Harbor, Maine 04860. ... From the Alumni Office I have received

word of the deaths of two other class members: **Hannah Moodey**, Course VI, of Lancaster, Penn., on December 10, 1978, and **George V. Schliestett**, Course XVI, of Bethesda, Md., on March 30, 1979. Hannah had graduated from Smith College and had an M.S. when she joined our class in the junior year. She has lived in Lancaster for many years and in the most recent Alumni Directory she is listed as retired. I have no further information. George was a graduate member of the class who also had a master's degree when he came to the Institute. For many years he lived in Pasadena.

On a happier note comes news from **Elmer Davis** that both he and his wife Jerry will have retired from M.I.T. by the time you read this. They will have spent the summer by the pool of the Eastern Yacht Club near their home in Marblehead. They plan to travel in the fall. . . . **David Mathias** writes from Montreal that after 25 years in the same location he has finally moved his architectural office into his home. He must enjoy not having to commute between the two.

Once again your secretary will be at home to any class members and their spouses who are able to travel to West Hartland by car, on horseback, on foot or by bicycle on Saturday, October 27. Make a note of the date and do try to come. — **Alice H. Kimball**, Secretary, P.O. Box 31, West Hartland, CT 06091

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Bert Bennison of 2109 Country Club Dr., Tallahassee, Fla., is still Senior Physician with the Leon County Health Dept., Fla. He writes he is "winding down an M.I.T. doctor's odyssey that has included malaria and cancer research at the National Institute of Health, stamping out TB, looking at carcinogenicity of standard oils, helping develop the "Pill" and the IUD, running a biology department and administering public health programs in Florida. It's been fun." His retirement plans are reading, writing and putting to music. His wife is mainly interested in the four children and in real estate. Three children are still to finish college; one is a computer-nik. Bert continues to travel from Florida to his home at Cape Cod at congenial intervals.

Fred Altman of 1212 Trinity Drive, Alexandria, Va., retired in April, 1973, and is currently a consultant with Computer Science Corp., Falls Church, Va. His latest publication is *Occurrence of Intense Rainfall* published by Annales de Telecom. Fred's youngest daughter is a teacher in Dayton, Ohio, his middle daughter is a mother in Alexandria, Va., and his son is a French professor at the University of Iowa. His son bought a house near Chartres, France, for an upcoming sabbatical. Fred worked on his son's house and his own to get his weight 3 lbs. below wartime. He is a member of the Sierra Club, hikes, takes language classes, and is trying to learn assembly machine language in AIM-65 computer, but finds it rough. Fred got a pilot's license but only used it to fly with friends in the last two years. He has done some gliding also. His wife is busy with church, National Symphony, and a granddaughter. They travel to France every summer.

James M. Ewell retired from Proctor & Gamble in Cincinnati, Ohio, in April 1979 after 41 years of service. James began his career at P. & G.'s Staten Island, N.Y., manufacturing plant in 1937, following graduation from M.I.T. He progressed through several plant management positions before assuming general responsibility for all of U.S. manufacturing in 1949. In 1953, after a two year assignment as director of manufacturing in England, he was appointed general superintendent of manufacturing for the company. In 1955, he was elected Vice President-manufacturing. In 1958, he was elected Vice President-manufacturing and employee relations. James was elected as a member of the Board of Directors in 1961, in 1973 he was elected a vice president-group executive and in 1976, a senior vice president. In addition to his responsibilities at P. & G., James is a director of Xomox Corp. He has been active in the Cincinnati community, having served as Chairman of the Board of Children's Hospital Medical

Center, and as a Board member for the Symphony and the Ballet Company.

Phil Bliss writes from 68 Theodore St., Newington, Conn., to share with us the fact that his youngest son, Jonathan G., started his graduate work at M.I.T. the week before the commencement exercises at Northeastern. Jon has been awarded a fellowship from the Department of Health, Science, and Technology for graduate studies leading to a Ph.D. in medical engineering. Phil writes that M.I.T. has come a long way since the Medical Department was an infirmary on Mass. Ave. He says they are still alive, Social Security is still a tax, and the class news is the first thing he reads in the *Review*.

Robert L. Alder has retired as of June, 1978, from Martin & Decker Co., Santa Anna, Calif., and has hung his shingle as "instrumentation consultant," primarily in oil well drilling instruments. He reports he is busier than ever and enjoying life. Bob and his wife live in Irving, Calif. . . . **Sidney Levine** writes that he is Senior Editor on 2 trade magazines, "Pit & Quarry" and "Modern Concrete," both published by Pit & Quarry Publications, Inc., Chicago, Ill. . . . **Leon Strauss, Jr.**, writes he is a retired real estate investor in Novato, Calif.

Samuel Noodleman reports that he is retired from Island Division, Kollmorgen, in February, 1979, where he had been Senior Vice President. He joined the University of Arizona as Adjunct Professor in the Electrical Engineering Department. . . . **Harry W. Kohl** writes that he retired from Lockheed Aircraft in 1974, and moved to Camano Island, Washington, in 1977. He is busy with consulting, residential design (an old hobby), and construction project management. . . . **S. Curtis Powell** has been selected as Regional Representative to the National Nominating Committee of the American Society of Mechanical Engineers in 1980. . . . **Robert C. Uddenberg** writes that he has come full circle from instructor at the University of California at Berkeley, 1938-40, to teaching systems management at the University of Southern California in 1979. After the 1938-40 stint at University of California, Robert joined Boeing Co. and spent 32 years primarily in missiles and the Apollo Space Program. In 1972 he became President of Sheldon Jackson College in Sitka, Alaska, and after two and a half years left in February, 1975.

It is with regret that I report the death of our classmate, **George F. Cary**, in August, 1978.

Our Class President, **Phil Peters**, wrote the following letter to **Bob Thorson** on his return from a recent trip to China. "You may recall that **Li Teh-Ching** was a classmate of ours at M.I.T. He and I were in Course VI-A together, and I got to know him well and enjoyed his company. Over the years, after going back to Shanghai, China, he disappeared from M.I.T.'s records and none of us heard from him. Ruth and I were recently in China and I tried to contact him and learned he had died in approximately 1967-68. He had been General Manager of the Shanghai Power Co. until the People's Republic came into power in 1949. Subsequently, he became a professor in one of China's universities and during the Cultural Revolution in the mid 1960's, was forced to go to the hinterlands, where he apparently taught in some institution. I was told that during his exile in the countryside, Li Teh-Ching developed cancer of the face and before this could be controlled, he died. His wife Nancy is reported to be a Wellesley College graduate; they had two daughters and a son. Apparently, Nancy and the children were able to leave China and may now be in the United States." — **Lester M. Klashman**, Assistant Secretary, 198 Maple St., Malden, MA 02148; **Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155

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Because of the gestation period of these class notes, I wrote about the Class dinner on Alumni Day at M.I.T.'s Endicott House prospectively. It was more successful than we had imagined. In attendance were the **Blacks**, the **Brewers**, the

Bruneaus, the **Coopers**, the **DesJardins**, the **Gardners**, the **Gordons**, the **Hopgoods**, the **Homers**, the **Kaufmans**, the **Kemps**, the **Leventhals**, the **Morses**, the **O'Connells**, the **Severances**, the **Trues**, the **Wadleighs**, **John Glacken**, and **Harold Strauss**. All attendees plan to return for a repeat performance next June. If you can't get gasoline, plan to hitchhike — it'll be worth it.

Dave Wright was elected Director of Nicor, Inc. It is **Don Severance's** recollection that Dave merged his company, National Marine Service, Inc. (trademark — an eager beaver) into Nicor.

Jack Crichton writes that, as chairman of Arabian Shield Development Co., he is actively working on opening up an old gold and silver mine last worked in the time of Sheba. . . . **Russ Coile** writes that he changed jobs last year, switching to Ketron, Inc., an operations research firm working on some projects for the Navy and the Marine Corps.

We recently received word that **Joe Krenn** passed away in February. **Dave Baker**, who had been on our reunion committee, passed away in April. *Atque ave vale.* — **A. L. Bruneau, Jr.**, Secretary, 663 Riverview Dr., Chatham, MA 02633

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The Reunion to celebrate our 40th year after graduation was held June 7-11 at Cambridge and Martha's Vineyard.

Overheard at one table: A woman remarked, "Some of the men are balding." Her companion replied, "After 40 years, they are finally coming out on top."

Attendance included 78 men and 70 ladies. The total was about 155 per cent of what the Institute predicted, based on its statistics for attendance by other alumni at their 40th reunions. This above-normal attendance record is further evidence that our classmates have unusual interest in each other, and I have sensed this over the years as I traveled much and visited so many classmates in their homes.

Attendance included: Helen and **Art Zeldin**, Gay and **Ben Badenoch**, Margaret and **Roy Haworth**, **Bob Youngquist**, Carol and **Sol Baker**, Anita and **Bill Wingard**, Mary and **Jim Barton**, Melba and **Fred Beale**, Edith and **Aaron White**, Austie and **Hans Bebie**, Arlene and **Irwin Weiss**, Eleanor and **George Beesley**, Julie and **Charles Wang**, Marie and **Pete Bernays**, Evelyn and **Bob Thompson**, Lucille and **Bill Brewster**, Lucille and **Oz Stewart**, Dodie and **Bob Casselman**, Madeline and **Dick Steiner**, **Wiley Corl**, Donna and **Win Steele**, Adele and **Max Coutts**, Theodora and **Paul Stanton**, **Perry Crawford**, Betty and **Bob Smith**, Billie and **George Cremer**, Jean and **Sid Silber**, Lenore and **Mark Curgan**, Sylvia and **Seymour Sheinkopf**, Ali and **Monarch Cutler**, Elaine and **Sam Sensiper**, Lois and **George Dadakis**, Mae Ann and **George Senior**, Jean and **Joe Dana**, Anne and **Fred Schaller**, Jan and **Eli Dannenberg**, Betsy and **Bob Sackheim**, Tom De Los Reyes, Jeanne and **Burt Rudnick**, Lillian and **Warren Evans**, **Ken Roberts**, Alicia and **Lawrie Fabens**, Lolita and **John Renshaw**, Sally and **Dave Frankel**, Adie and **Bill Pulver**, Bernice and **Charlie Friedman**, Nancy and **Gordon Pope**, Evelyn and **Paul Gordon**, Viola and **Hew Phillips**, Jean and **Barry Graham**, Mary and **George Pfaff**, Ginny and **Fred Grant**, Beatrice and **Irv Peskoe**, Lucille and **John Herlihy**, Berta and **Larry Perkins**, Prilla and **Gus Hunicke**, Sylvia Arntstein and **Eliot Pearl**, Jackie and **Will Jamison**, Caroline and **Art Olson**, Ruth and **Earp Jennings**, Grace and **Myron Norman**, Yolanda and **Ernie Kaswell**, Barbara and **Ernie Ohsol**, Louise and **Vahey Kupelian**, Betty and **Joe Neuendorffer**, Mary and **Martin Lindenberg**, Helen and **Bill Murphy**, Beatrice and **Burns Magruder**, Betty and **Harold Muckley**, **Leonard Mautner**, Connie and **Manning Morrill**, Blossom and **Joe Mazur**, Ruth and **Maurice Meyer**, Louise and **Charlie Mercer**, **Mort Metzger**, and Hilda and **Hal Seykota**.

It was a joy for us all to be there and to relax in the company of our classmates with whom we had shared 40-plus years of mutual friendships, experiences, and confidences.

It is appropriate to recognize classmates and others who worked so hard for many months to make our 40th Reunion such a success. Sixteen men were named to the letterhead. Probably more than that made significant contributions. However some classmates extended themselves extraordinarily: There was agreement that Chairman **Seymour Sheinkopf** did the most. However, when I visited with him about this, Seymour would agree only to taking full credit for having arranged the splendid weather.

President **Ernie Kaswell** was ever in the vanguard. At the Technology Day Luncheon in Rockwell Cage, Ernie presented to M.I.T. \$970,000 donated by '39ers during the last five years. Ernie suggested from his podium that the extra \$30,000 — to make it an even million — be donated by some '39 classmate, or else by an alumnus from a different class. Ernie's suggestion resulted in the donation of an extra \$400 from a non-'39 alumnus who asked to remain anonymous. Ernie's concise and humorous presentation speech was so outstanding that an alumnus, seated at a nearby table, leaned over to me and whispered: "Your '39 speechmaker is the only one up on that whole platform that we can hear and understand over that public address system."

Aaron White contributed to many elements. He selected Russ Kelsey's Band to entertain and play for dancing at Martha's Vineyard. It is a special tribute for both Aaron and Russ that so many classmates were on the floor, dancing, for so much of the evening, instead of being on the sidelines, talking. And weren't Pat Kelsey's vocals strong and polished and right on target for reminiscing about the Big Band Days and our Proms! Aaron: how about asking Russ and Pat how they feel about doing an encore at our next reunion which some classmates are talking about convening in Shanghai?

Fred Schaller handled the finances. The budget was about \$8,000 and included about \$2,000 from class dues. All expenses were covered by revenues, which proves that our class does better than our Federal Government. Also, it proves Fred was the right choice for handling our "long green with the short future." Fred also handled the transportation between Burton House and Edgartown.

Seymour, Ernie, and Aaron formed the questionnaire, and then sent the 95 responses to **Irv Peskoe**. Irv assembled, interpreted, and summarized the lot to become a masterful five-page, single-spaced document entitled "'39 Going on Our 40th." Classmates can get a copy by sending Irv a dollar to cover copying and mailing costs. Mail requests to 1000 North Krome Ave., Homestead, Fla. 33030. Irv's postscript reads: "Many of our classmates turned out to be creatures of habit, in that each father, after having worked his way through college, then worked his son's way through."

Joe Dana helped choose the site and he arranged all the recreational activities at Martha's Vineyard.

Martin Lindenberg showed color slides of classmates furnished from collections of Sheinkopf, Lindenberg, and Seykota.

Special recognition is due to all our ladies. 70 of them attended and they supported our reunion with the same strength and love they applied to us for, lo, these last 40-plus years. To our ladies we each send boundless love.

Julie and **Charlie Wang** came from Shanghai, about 9,000 miles away. President **Ernie Kaswell** presented their award for having traveled farthest to attend our reunion. The award was an M.I.T. pennant with its letters in Chinese script. Charlie's speech about his experiences in China during these last 40 years, and Julie's vocal solos, were especially well-received. We join China in being proud of two such fine ambassadors.

Tom De Los Reyes came from Quezon City in the Philippines. Enroute, he visited a number of his Course XVII classmates. At Saybrook, Conn., Tom joined **Bill Willard** and both traveled to Cambridge where they joined other classmates at Burton house.

Shortly before our buses were to leave Burton House, disaster struck Bill Willard. At first they all

thought Bill got what has been characterized as Delhi Belly, Gypsy Tummy, Turkish Trots, or just plain old Montezuma's Revenge. After his first terrible discomforts had ended Bill felt weak, but well enough to fend for himself, and he asked Tom to rejoin his classmates who, by that time, were all aboard the buses. The next day Bill traveled home alone, by then much lighter and some sicker. I can't spell what was later diagnosed to be the cause of Bill's upset, but it produced inner ear imbalance, nausea, and severe discomforts which kept him in bed for the next 12 days. Bill says he hopes to be fully recovered within the next six weeks after which he expects to resume leadership of the insurance company he founded 18 years ago.

Nick Ferreira, who lives in Sasolburg, South Africa, will be receiving written notes of goodwill and reminiscences from 58 classmates who paused during reunion to send him their handshakes across about 8,000 miles of ocean.

President Ernie Kaswell presented certificates of appreciation to **George Beesley** who served as Class President between 1964 and 1974, and to **Oz Stewart** who served for many years as Class Secretary and Class Agent.

At our Class Meeting the Nominating Committee took the easy way out, and so did our classmates. As a result the Class Officers were re-elected to serve another five years. Class Officers include: President **Ernie Kaswell**, Vice Presidents **Aaron White** and **Oz Stewart**, Treasurer **Seymour Sheinkopf**, Class Agent **Fred Schaller**, Estate Agent **Manning Morrill**, Secretary **Hal Seykota**.

Some interest was generated by Charlie Wang's invitation to hold a future reunion or meeting in Shanghai. For details about this write Seymour Sheinkopf, 205 Wolcott Rd., Chestnut Hill, Mass. 02167.

Hilda and I were pleased when **Bob Saunders** interrupted his busy schedule (in carpet industry consulting) to visit us at Atlanta airport between planes, as we were enroute to reunion.

Here are some news items not directly connected with reunion:

Richard Steiner was awarded Life Membership in the American Society of Civil Engineers, Maryland Section. Fred has earned many honors in City Planning for Baltimore and the University of Maryland, and he received the Distinguished Service Award of the American Institute of Planners.

We are saddened by news of the death on March 13, 1979, of **Norman MacBeth**, Chairman of the Board of Kollmorgen Group. There were no details.

Fred Gemmill was elected Selectman for a three-year term at the Town Meeting of Hollis, N.H.

Kenneth Madsen is active in the design, construction, and marketing of apartments and condominiums in Palm Beach County, Fla.

Moses Cammer wrote his master's thesis 40 years ago on "Flat Plate Collectors for House Heating by Sunlight." Since then he has jostled his share of solar energy windmills until now the sun is finally shining through on him. The *New York Times* published two large pictures of Moses with the solar heating system he designed and built at Morty Arkin Memorial Field near the Triborough Bridge in Queens. The exciting story leads off: "The first solar energy system operating in a public building in New York City is providing hot showers for tennis players . . . and the project was managed by Moses Cammer who concurrently provided work experience and teaching of skills to unemployed young people who lived nearby." Our classmates join in sending their congratulations, Moses, for your stick-to-it-ness and for winning in the end. — **Hal Seykota**, Secretary, 1421 Calle Altura, La Jolla, CA 92037

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Our Man in Boston: **Leo Pach** writes: "My wife and I enjoyed the Technology Day lunch on June 8. This time I talked to a former dorm-mate whom I had not seen for 39 years, of the class of '41. But, as in the previous two years, I did not meet any '40

classmates, possibly because the lunch was the only event we attended."

40th Reunion Reminder: Preparing for the Happening — **Bruce Duffett** (President of Class of 1940), 5900 Overlook Dr., Erie, Penn. 16505, has **Jack Danforth** (35 Farm Ln., Westwood, Mass.) working on details of the June 4 and 5, 1980, reunion. On October 12-14 in Hershey, Penn., **Norman R. Klivans** (14731 County Line Rd., Chagrin Falls, Ohio) will lead a mini-reunion planning session. They want your suggestions and interest.

Regrets: **Samuel L. Cohen** has had to resign the class historian task because of major illness. We join Sam in seeking a replacement. Contact Bruce Duffett directly.

In the Hereafter: Retirement news is a regular feature now. Here are some notes on the change of life: No more watches — **Edward S. Carmick** is fully retired — a gentleman farmer on a hillside two acres in Saratoga, Calif. He plans to attend his 50th reunion at the Naval Academy next year. . . . Cryptic **John H. McQuilkin** sends a note with only the words: "in the process of moving — south." . . . Peace, woman! **Jane S. Rodman** has returned to her farm in Maryland after five years in the Peace Corps, doing city planning for the government of Gambia in West Africa.

The Married Life: **Richard G. Falls** has five sons, now all married, and a daughter, a junior at Russell Sage College, and a growing list of grandchildren — after thirty-seven years of marriage.

No Let-Up: **Clement F. Burnap** is still with Kaiser Engineers. He writes, "After two years' work in the States on the People's Republic of China's potential steel, iron ore, coal products, we received contracts for the first phase of two iron ore mines. Elaine and I went to China last November, our 101st country. Since I had studied some Mandarin during the fall, we had an especially interesting trip." — **Frank A. Yett**, Secretary, Box 488, Seaview, WA 98644

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News this month from **Walt Keith, Jr.**, one of my Course X friends. He writes, "Assumed chairmanship of my company, the Hygenic Corp., in February, 1978. Lost my wife Rosamond in October 1978. Two of my three children married, one to go. No grandchildren as yet. Son Walter III joining company in June, 1979."

Lt. Gen. **Tirso Fajardo**, who retired as Commanding General of the Philippine Army, is a consultant in management in Manila.

Albert Parsons, Jr. has joined the staff of CBT/Childs Bertman Tseckares and Casendino, Inc., Boston architects. Al is a registered professional engineer and a licensed superintendent of construction. His S.B. was in building engineering and construction, and he has been a practicing engineer for 30 years. Before joining CBT he was affiliated with numerous Boston-area construction, engineering, and architectural firms, where he held positions as resident engineer, project manager, and construction supervisor of housing and health care facilities. CBT projects in which Al was involved include Pine Street Inn, Boston; Cotton Mill Apartments, Hallowell, Maine; and the Lowell Visitor's Center, State Heritage Park, Lowell, Mass.

Nat Owen, whom I haven't seen since he was involved in the Spencer Chemical investment venture, received an honorary degree from Clarkson College. Nat is chairman of the board and chief executive officer of General Signal Corp. and a director of several companies, including Marine Midland Banks, Inc., Great Northern Nekoosa Corp., and General Reinsurance Corp. He is also a director of Technoserve, an organization designed to offer technological assistance to underdeveloped countries.

Reid Weedon, Jr., who is chairman of Arthur D. Little International, Inc. and senior vice president of Arthur D. Little, Inc., has been elected director of the Rowe Price New Horizons Fund in addition to his being director of the T. Rowe Price Growth Stock Fund.

Reunions





Frank Mead (left), the 50th Reunion Gift Chairman for Class of 1929, presented to Jerome B. Wiesner, President of M.I.T., \$1,071,000, the third largest 50th Reunion gift given to M.I.T.



Opposite page, left (top to bottom): John J.A. Nolan, '03, was the oldest alumnus to attend Technology Day 1979.

Representing Class of 1914 were (left to right) Fred Karns, Harold Wilkins, Leon Marsh, Charles Chatfield and Ros Barratt.

Members of Class of 1916 and their guests met at Chatham Bars Inn to celebrate their 63rd Reunion: (seated, left to right) George Crowell, Paul Duff, Barney Gordon, Ralph Fletcher, Nat Warshaw and Bob O'Brien; (standing, left to right) Bruce Crowell, Frances Duff, Betty Crowell, Sibyl Fletcher and Rose O'Brien. Also attending the reunion but not shown were Frieda and Hy Ullian.

Celebrating their 60th reunion, Class of 1919 and guests included: (standing, left to right) Wilfred Langille, Royden Burbank, Milton Loucks, Russell Palmer, Ralph Gilbert, Everett Doten, George Bond, Jr., Irwin Sizer (guest speaker), Donald Way, William Vogt, Jr., Robert MacMullin, Louis Grayson, George Michelson; (seated, left to right) Florence Langille, Catherine Loucks, Jean Sheeline, Olive MacMullin, Alice Grayson, Mrs. Sizer and Barbara Way. Missing from the picture but attending the reunion were Larry Riegel and Suzanne and Oscar de Lima.

Reunion activities pictured include a softball game, browsing through old yearbooks, and a New England style clambake.



Condolences to the families of **Frank Sexton**, **Elwood McGee**, **Victor Wagner**, **Arthur Walsh** and **Alfred Schneble**. Keep sending in your information. — **Henry Aucry**, Secretary, U.S.S. Chemicals, Suite 2858, 600 Grant Street, Pittsburgh, PA 15250

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John Cantlin writes that he is Executive Vice President and General Manager of Hudson Lock Company in Hudson, Mass. . . . A note from **Norm Lacey** reports that he is Aviation Advisory Meteorologist at F.A.A. headquarters in Washington. . . . **Adrian Marcuse** sends a paradoxical note on his Alumni Fund form: "Not much new. In the past year I have had two daughters get married (that's not new? — Secretary's note) — and in principle, am now convinced the groom's family should give all wedding parties."

Another Technology Day has come and gone but this year our class had only a small select representation — saw **Paul Hotte**, **Bob Howard**, **George Schwartz**, **Floyd Lyon**, **John Lacy**, and of course our in-house representative — **Bob Seamans**, Dean of the School of Engineering.

Spoke with **Floyd Lyon** about the progress in raising our 40th anniversary \$1 million Class of 1942 Chair. Things have started out very well, all of the class officers and members of the committee have come through with gifts and pledges. Please keep the ball rolling when the committee representatives in your area come to put the "arm on you!"

Sadly, four obits this month. **Charles Davenport** of Dayton, Ohio; **Deane Lent** of Cohasset, Mass.; **Ben Kingsbury** of Marina Del Rey, Calif.; and **Hans Aschaffenburg** of Concord, Mass. We send our sympathy and sincere condolences to their families. — **Ken Rosett**, Secretary, 191 Albemarle Road, White Plains, NY 10605

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The important matter for these notes is the Reunion — our 35th. It was held in Cambridge and in Bermuda and wherever our classmates were when they thought about each other, about the Institute and about old times together. Events started with registration at Burton House on Thursday afternoon. We were able to secure a small dining room at the Student Center so we could enjoy our pre-Pops buffet dinner together. After the Pops concert we were taken by bus to the M.I.T. Historical Collections where the gals received the reunion beach bags, we all had pizza and beer, renewed old friendships and made new ones, and appreciated seeing pictures of us and M.I.T. during our student days. Following Technology Day activities, we went to Lexington for a Chinese wedding banquet. Upon arrival the gals were asked to select for the guys the reunion T-shirts adorned with a copy of the yearbook picture. Between courses **John Hull** taught us how to say "How are you?" and "I'm fine" in Chinese; **Bob Breck**, Chairman of the Nominating Committee, presented the slate of Class Officers for the next five years; and the following were unanimously elected: President — **Norman Sebell**, Vice Presidents — **Frank Carroll**, **Albert Hildebrandt**, **John Hull**, **Robert Hunter**, **Paul Robinson, Jr.**, Treasurer — **Stanley Warshaw**, Secretaries — **Melissa** and **Newton Teixeira**.

Saturday morning we left Boston for Bermuda. That evening **Bob Cummings**, dressed in full Scottish regalia, entertained us with his pipes at our rum-swizzle party. At the Monday night beach party, our next scheduled activity, Rose Mary Aguilu won the limbo contest. The last official event for the 35th was the Tuesday evening banquet. Bermuda memorables: "Chug-a-lug that B & B and let's hit the sack." The impromptu Grand March off Monday night led by **Bob Cummings** and his pipes that roused the whole hotel. **Warren Bishop** carrying the Castle flag to provide the parade with "colors." Another parade the next night, with **Bob** in full regalia, and one of the guests of the hotel joining in the class spirit. **Bob**

Storrs making a guest appearance at the Castle Bar one night and then providing all the entertainment on the grand piano there our last night in Bermuda while the regular pianist was performing elsewhere in the hotel. **Ruth Sebell's** informal pool party. The spur-of-the-moment beach party by your secretaries. The unscheduled swim of **Peter Matthews**. The appeal of the Black Knight who stood guard at the far end of the Castle Bar. The Bromfield 35th wedding anniversary. Eighty-one classmates, spouses, children, and friends at Bermuda. The post-Pops beer and pizza party was such a success that we missed getting the names of those at Cambridge, so we made sure we collected the names and addresses of all the Bermuda attendees. Our apologies if your name is missing from the following list: **Rose Mary** and **Joe Aguilu**, **Marguerite** and **Ed Ahlberg**, **Bob Bartz**, **Dorothy** and **Bob Benedict**, **Charlotte** and **Roland Benjamin**, **Danny** and **Warren Bishop**, **Priscilla** and **Bob Breck**, **Anita** and **Les Brindis**, **Bobbi** and **Burt Bromfield**, **Jill** and **Tom Carmody**, **Frank Chin**, **Bob Clarke**, **Andy Corry** and son **Jay** and sister-in-law **Alice**, **Sue** and **Lee Corton**, **Beth** and **Ray Corwin**, **Barbara** and **Bob Cummings**, **Hope** and **Art Dershowitz**, **Sarita** and **Gonzalo Docal**, **Betty** and **Lamar Field**, **Dorothy** and **John Gardner**, **Nat** and **Dick Hatfield**, **Paul Heilman**, **Maddy** and **Jim Hield**, **R. J. Horn**, **Warren Howard**, **Buz** and **John Hull**, **June** and **John Hunter**, **Elaine** and **Bob Hunter**, **Leslie** and **Jim Kane**, **Tom Kelly** and two daughters, **Glenna** and **Herb Knappe**, **Carmen** and **Larry Lamadrid**, **Jean** and **Walter Lang**, **Carol** and **Stan LaVallee**, **Dorothy** and **Hank Lawton** and son **Doug**, **Al Madwed**, **Peter Matthews**, **Elvira** and **Arturo Morales**, **Betty** and **Sam Morrison**, **Dot** and **Peter Rinaldo**, **Ken Rehler** and daughter **Kris**, **Milena** and **Ed Roos**, **Mary Kay** and **Jim Ruoff**, **Ruth** and **Norm Sebell** and sons **Mark** and wife **Amy** and **Bruce** and wife **Jeanne** and friends **Ruth Galen** and **Ruth** and **Jerry Kornreich**, **Joan** and **Charles Simpson**, **Rita** and **Caesar Spero**, **Estelle** and **Victor Stanley**, **Mary Ellen** and **Bob Storrs**, **Melissa** and **Newton Teixeira**, **Dorothy** and **John Toland**, **Dot** and **Walt Turner**, **Carmen** and **Bill Van Ravensway** and sons **William** and **Chuck**, **Edna** and **Stan Warshaw** and daughters **Ruth** and **Debbie** and husband **Bruce**, **Marjory** and **Dick Whiffen** and daughter **Karen**, **Alison** and **Bob Wood**, **Doris** and **Chet Woodworth**, **Marcene** and **George Ziegler**, and special friends of our classmates, **Albertina** and **Sam Valencia** '49 of M.I.T. and **Peter Engel** '54 of M.I.T.

The Technology Day program was inspiring as it has been for the past several years. Most of you have seen the program so we'll just touch on some of the highlights. **Jordan Baruch**, '47, now Assistant Secretary for Science and Technology, Department of Commerce, was in rare form as the keynote speaker in the morning at Kresge and panel moderator in the afternoon at 10-250.

For us, the student panel made all alumni effort worthwhile. What a splendid group! Individually and together they flashed a picture of M.I.T. that was varied in its gifts and universal enough to bring out the gifts within each student. They showed in clear but dramatic statements and answers how liberal arts, in the total sense, can no longer justifiably exclude the scientific and technological background that alone can illuminate the economic, political and social problems facing today's world.

A news release from the American Institute of Chemical Engineers informs us that **Page S. Ufford**, Design Project Manager at DuPont in Wilmington, has been named Chairman of the Equipment Testing Procedure of the AIChE.

Named for our beloved classmate, the **Malcom G. Kispert** Award, presented annually to the Senior Scholar-Athlete of the Year, was received by **Leonard E. Dolherr** '79 at the Awards Convocation at M.I.T. on May 11.

On behalf of the class we extend our sympathies to the families of classmates to whom we bid farewell: **Dr. Richard A. Craig**, Tallahassee, Fla.; **Harry S. Myers, Jr.**, Covina, Calif.; **Richard B. Palme**, Flemington, N.J.; and **Anthony J. Szykiewicz**, Staten Island, N.Y.

And, in memoriam, **Clarke Jefferson Teixeira**,

1958-1979. — **Melissa** and **Newton Teixeira**, Co-Secretaries, 92 Webster Park, West Newton, MA 02165

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The following list not only represents Tech Night at Pops attendance on June 7 but more importantly a group that properly chastised your Secretary for indiscrete non-performance to these several months: **Nancy** and **Charlie Hart**, **Ann** and **Bob Magliathlin**, **Louise** and **Tom McNamara**, **Jan** and **Charlie Patterson**, **Mary** and **Jerry Quinnan**, **Ed Stoltz**, and my good wife **Fran**. I hasten to add that we indicated our inactivity was caused by a void of news. "No excuse!" shouted the troops. **Jim Gurney** from Cape Cod and **Art Miller** of Princeton, N.J. were also on the scene for Technology Day.

Nine months from now we will be celebrating our 35th Reunion under the able direction of **Bill Shuman**. Although we will incorporate both the Pops and Technology Day in the program, the basic social activities will be at Wechmere Harbor Club which continues in the minds of many as the Snow Inn at Harwichport, Mass. Please reserve June 5-8, 1980, for our festive 35th Reunion; details will be forthcoming.

The mails have been lean — yet **George "Curly" Bickford** continues at Carrier in Syracuse as manager, physical distribution. **Bill Roseborough**, U.S.N. Retired, still works with the U.S. Agency for International Development (A.I.D.) as Chief of the Environmental and Natural Resources Division in the Office of Science and Technology. Yes, **Bill** is trying to get the developing countries to conserve their resources and protect their environment.

Guy Gilleland was recently made senior vice president at Barnett Banks Trust Co., in Orlando, Fla. **Guy** manages the real estate account within the bank's trust and estates department. . . . **George E. McKewen** now lives in Park Ridge, Ill., convenient to International Metals and Machines, Inc., at O'Hare. **George's** son **Glenn** graduated from Rochester Institute of Technology, and son **Gary** attends Graduate School of Business, Western Illinois University at Macomb.

Belated congratulations to **Bill Linvill**, professor and chairman, Department of Engineering and Economic Systems at Stanford University, on his election to the National Academy of Engineering, for contributions to rational analysis of complex socio-economic engineering systems and to education in this area. . . . **Cyril N. Harris** has recently rewritten his *Handbook of Noise Control* to reflect the profound changes in the field during the last two decades. . . . **H. Paul Grant** continues to reflect his *VooDoo* humor when he reports, "Last three of eight kids now in college. Will come up for air in 1982!"

Two belated obit notices — **William J. Duffey** in Cincinnati on December 6, 1978 (no details) and **Dr. Wu-Wai Chao**, '56, of Wilbraham, Mass., on February 11, 1979. Born in Shanghai, **Dr. Chao** had a S.B., M.S. and Sc.D. all in Course II and had been employed by Stone and Webster in Boston for ten years. Before that he worked for the Vickers Division of Sperry Rand. **Dr. Chao** leaves his wife **Sogel**, three sons — **Bruce**, **Matthew** and **Stephen** — a brother in Paris, and three sisters in Taiwan. — **Clinton H. Springer**, Secretary, New Castle, NH 03854

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Pat and **Don Burke** spent some windy March days in Bermuda. They saw **June** and **Giff Stanton**.

Major General **Hillman Dickinson** U.S.A. of Fort Monmouth, N.J., was promoted to Lieutenant General on June 25, 1979.

We regret to advise that **Alfred B. Rose** of Toronto, Ontario, died on November 6, 1977. **Merwin R. Burman** of Highland Park, Ill., passed away on December 10, 1978. — Until next time, **Russ Dostal**, Secretary, 18837 Palm Cir., Cleveland, OH 44126

Bob Devine writes: "Launched my own operation over two years ago, Robert Devine Associates, as a division of a member firm of the N.Y. Stock Exchange, Moore and Schley, Cameron and Co., 2 Broadway, New York, N.Y. 10004. We do investment strategy for large equity portfolios."

Watt Webb, professor of applied physics, has been at Cornell since 1961. Most of his work is in biological physics, working on fluctuations in various systems of condensed matter which led to work in biological systems. Twin son Spahr, Course VIII, 1978, is now in physical oceanography at Scripps Oceanographic Institute. Twin Bucknell went to Harvard, '78, also in physics, and is in graduate school at Cornell in physics.

Donald Espey, now in marketing services, has been with Exxon since graduation. He and his wife Betty live in Houston, Tex. ... This year continues to be a most productive one for Karmazin Products Corp. **John Karmazin**, chairman of the board and president, writes: "Karmazin has derived considerable benefit from participation in the Associates Program ... we have renewed our membership for 1979-1980."

Dick Knight has made a good recovery from a heart attack. He is back in harness at the Alumni Office. ... **Jack Rizika**, **Parker Symmes**, **Claude Brenner**, and **Ginny Grammer** participated in the Alumni Fund telethon. Much of the information this month comes from those conversations. Thanks, J, P, and C! ... **Jack Mohr** said to say nothing: he's hiding. **Karol Hujak** is not: he is with Hyco Corporation, Tulsa. ... **John Shrack**, Columbus, Ohio, started his own heating and air-conditioning business in February. He serves central Ohio, both wholesale and retail.

The telephone company building in New York City is being built by Koren Diresta Construction Co. — **Michael Lagana**, Vice President. **Theodore Hogg** is a design engineer at Caterpillar Tractor, doing concept work in special applications of the backhoe. He and wife Mary have two children in high school.

Domenic Baccari is at General Dynamics, Quincy: Nuclear Surface Project Manager. He lives in Cohasset with wife Yolanda and daughter Jeannie, 13. He has two sons, Greg, 21, and Paul, 26. Paul passed the bar this year.

A safety note from **Colonel Thaddeus Nosek**, Alexandria, Vir.: Use a towel when you open champagne. His hand has been in a cast since Easter, when he cut a tendon while doing the honors. The Noseks spent seven years in Panama prior to 1977, where he developed the water system for Panama City and she organized the foreign ladies in orphanage work. Before that, he was Commissioner for Public Works in Micronesia, following an early retirement from the U.S. Corps of Engineers. Travel ad for Panama: good climate, with only one day without sun even in the rainy season. Never over 90 degrees, but humidity is high. Year-round golf.

Ginny Grammer (there I am, in bold letters again) is planning to spend August in Brazil with daughter Margaret, who is a staff writer for the new English language *Latin America Daily Post*, in Sao Paulo, and a stringer for A.B.C. Radio. We have the use of a house in Rio, and I also hope to visit her old beat in Brasilia as well as the new one in S.P.

Bob Peach, Lagrange Park, Ill., is in Quality Assurance at Sears Roebuck. This means worldwide traveling (twice to Geneva this year). Part of his travel is for work on the International Standards Committee.

Professor **Vince Haneman** has just resigned as Dean of Engineering at Auburn University, Auburn, Ala., so that he can devote more time to teaching and research. He is currently doing research on the engineering manpower shortage. He is the president elect of the American Society for Engineering Education for 1979-80 and will be president during 1980-81. He is also the national director of the National Society of Professional Engineering (1979-82) and on the committee for the National Conference for Advancement of Research. Vince is still a major general in the Air

Force Reserve, attached to the Deputy Chief of Staff for Research and Development, and is an ad hoc member of the Scientific Advisory Board of the U.S.A.F.

I have just received notification of the deaths of **George E. Bierce, Jr.**, January 27, 1977, and **Vincent P. Goddard**, July 26, 1977.

Remember, you can reach me direct at 62 Sullivan Street, Charlestown, MA 02129. Love to you all, **Ginny Grammer**, Secretary

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We had our first mini-reunion after Technology Day on Friday, June 7. **Graham Sterling's** letter of April 17 resulted in 12 classmates and their wives gathering at the Harvard Club on Commonwealth and Mass. Ave. for cocktails and dinner.

Malcolm Reed, Gloria Monosson, Rose LaFreniere and Nancy Noble arranged the dinner. They devised a contest that resulted in a seating arrangement for dinner that placed spouses at different tables. I had the pleasure of Rose LaFreniere on my right and Tel Sandman on my left.

After dinner your class secretary had a field day as everyone said a few words about their current activities. **Graham Sterling** described his stewardship of the chapel his church is building. At present it is an enormous cavern of a room which will have a stained glass window. Professor Kepish accepted responsibility for the design of the window, and Graham plans a slide show to help raise the \$250,000 needed to finance the project. Judy Sterling is a trustee of Dana Hall and a '48 housewife.

George Clifford is traveling to Europe for the Medical Products Group of Corning Glass. George is manager of market research for all their international markets. He is also a trustee at his condominium in Framingham. George's son graduated from M.I.T. in June.

Leon LaFreniere's wife Rose is employed by the summer session office at M.I.T. Leon missed dinner because he was initiating Boy Scouts into Order of the Arrow at an Ordeal.

Sonny Monosson is going to write a book, *If You're Going to Live, You Might as Well Enjoy Yourself*. Sonny's children have all graduated from high school; his garden is growing "good"; and his wife Gloria is growing "good." Now he feels the book he is planning is the "significant" thing to do. Sonny still remembers playing bridge in Walker Memorial at the 5:15 Club with **Leon LaFreniere**.

Jeann and Milton Slade met at M.I.T. They have built a vacation house at Long Lake, Maine. The foundation was poured bucket by bucket. Milton's work is project management at Sylvania. This is his fourth job since graduation. Their four daughters range from high school to graduate school. One daughter works in Quincy Market at Faneuil Hall.

John Walch is playing the horses. John has been quite successful in several speculative high-risk situations, including common stock and horse racing. He is chairman of M.I.T.'s Educational Council for northern New Jersey, senior warden at Grace Episcopal Church in Nutley, and active in Republican political campaigns. His wife Zaida is a librarian, and his oldest daughter Grace graduated from New England College in May.

Eleanor and **Harry Ottobriani** are enjoying golf, tennis, sailing, and skiing together. They recently visited Heidelberg, Germany, where they spent 10 months in 1953-54. Harry sold his interest in MetCeram to a German company. He has made a series of investments including some Rhode Island real estate, a sailing sloop that is chartered in the Caribbean, and a toothpick manufacturer in Vermont. He is looking forward to the M.I.T. fiesta in Mexico City next spring. (Harry and **Dick Harris** are planning a mini-Reunion for our class during the 1980 fiesta.)

Verity Smith sells water purification equipment around the world. He visited 14 cities in 28 days on his last trip around the world. In Egypt he took time out to see the pyramids. Anita is going to write a book about life with Verity and their nine

children. Everyone is always waiting for Verity to come home.

Bob Sandman has lived in Newton most of his life. He ran for public office and won. Now he spends 20 hours per week on the local board of aldermen. He had accepted responsibilities as an officer leading to the presidency of his National Trade Association. Between these activities he ends up having about one day a week to tend to his own electrical equipment business. His wife, Tel, said it was fun to be at the Harvard Club with the Class of 1948. She is a social worker at Boston Hospital for Women. Tel has done some writing and speaking.

Nancy Nolan spoke for the Nolans since **Don Nolan** was unable to be with us. They had had an A.F.S. student from Italy during the past year. Their daughter Pam graduated from Yale Divinity in May. Nancy is teaching English as a second language for Italians and she is assistant treasurer of Don's heating, ventilating and air conditioning business.

Mal Reed is at Kurzweil Computer Products in mechanical engineering. He redesigned the scanner portion of a machine for reading to the blind. He is on the committee to improve his church's facilities by making the building more weather-tight to conserve heat. His community elected him to their Town Meeting Committee. He and Barbara go cross-country skiing in New Hampshire. Barbara is a full-time physical therapist. Two of their children are in college. Mal's committee did a wonderful job of arranging our dinner, and as secretary I appreciated his program which provided this news.

My daughter Amy graduated from Yale, magna cum laude with distinction in her major, biology. She is spending eight weeks at the American Institute for Classical Studies in Athens. She plans to apply to medical school for the year 1980-81.

R. Douglas Watson has been named Executive Vice President/National Markets for A.T.&T. Long Lines, the Bell System unit for interstate and international communications. He will be located in Bedminster, N.J. Douglas has been with A.T.&T. since graduation.

George M. Keller returned from a trip to China where he was seeking to help the Chinese in exploring and recovering offshore oil resources. George led a five-man delegation sponsored by Caltex Petroleum Group which is jointly owned by Socal and Texaco. George is chairman of Socal, a Standard Oil company.

John C. Adams, Jr. of Gulfport, Fla., president of Coffin and Richardson, Inc., of Boston, died in a St. Petersburg hospital after a brief illness. He joined the firm after graduation and practiced sanitary engineering. He had been president since 1962. George was the author of several published technical papers and received awards for two of the papers. A memorial service was held in Marblehead.

Trafton H. Bean of Boulder, Col., died on a beach in Lanai, Hawaii, of a sudden stroke. He graduated with a degree in city planning and had been in charge of city planning in Boulder for 28 years. On behalf of our classmates, I extend our sympathy to the families of John Adams and Trafton Bean. — **S. Martin Billett**, Secretary, 16 Greenwood Ave., Barrington, RI 02806

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Charles P. Puksta (XV), manager of training at Jones and Lamson Tectron, Springfield, Vt., was recently appointed chairman of the New Hampshire Advisory Council for Vocational-Technical Education. He has already served vocational education in various capacities on the local and state level, and he has served three terms on the National Advisory Council for Adult Education, including its chairman during 1974-75. He is mayor of Claremont, N.H. ... **Robert W. Mann**, (II) Whitaker Professor of Biomedical Engineering at M.I.T., was the 37th recipient of the New England Award of the Engineering Societies of New England last spring, presented for "outstanding contributions to the engineering profession." ... **Samuel M. Tennant** (II) has been elect-

ed group vice president of the Development Group at The Aerospace Corporation located in El Segundo, Calif. Sam joined Aerospace in 1961.

Warren Marcus (XV) has been living in Brussels for about two years and working for ITT Europe as manager of industrial engineering. His work takes him to all the countries of western Europe on a regular basis. His two daughters are out of college and his son is finishing his first year at Colby College in Waterville, Maine. This leaves Warren and wife, Florence, relatively free to dissipate their meager resources traveling in Europe. He says if the dollar manages to stabilize, they should run out of cities to visit before running out of dollars; if not, they will learn to enjoy the Belgian national foods — beer and french fried potatoes. Warren is looking forward to the 30th reunion in 1980.

John T. McKenna, Jr. (X) has been named senior vice president-operations at Boston Gas Co. His responsibilities include gas supply and production, all plant facilities, engineering, distribution, and customer service. Jack joined Boston Gas in 1950 and has held several positions in the operations and customer service areas. He was elected assistant vice president of gas operations in 1970, vice president of operations in 1975, a member of the Board of Directors in 1976, and vice president of planning and gas supply in 1978.

We were deeply saddened to hear of the deaths of three of our classmates.

John R. Keefe, Jr. (I), of Winchester, passed away in June, 1977.

Joseph F. Regan (XV) died on April 12, 1979. He was marketing manager with the Raytheon Corp. and had been on the Raytheon staff for 27 years. For many years Joe worked with the young people in his town, and he was a member of the Lexington Badminton Club. He leaves a daughter Martha Cortina, of Salem, N.H.; a son, Stephen, of Glen Falls, N.Y.; a brother, Philip, and his mother, Grace (Butterworth) Regan, both of Zephyr Hills, Fla.

Representative **David B. Kret (IX-B)**, a 15-year legislative veteran and one-time majority leader of the Arizona Senate, passed away on May 10, 1979, of an apparent heart attack. He served eight years in the Senate and seven years in the House. He ran for state school superintendent in 1974 and was last elected to the House in 1978. Dave was the founder and president of a management consulting firm and fiscal chief of a project investigating the link between learning disabilities and juvenile delinquency. He won the Gene Flannigan Award of the American Educational Finance Association last January for a doctoral dissertation. He leaves his wife, Estelle, and children, Martin, Steve, Dorothy, Debra, Bernard, and Carol.

Leo Sartori (VIII) is on leave from the University of Nebraska to serve on the staff of the Arms Control and Disarmament Agency in Washington. He is working on the SALT negotiations and finds the work very different from physics but extremely interesting. . . . **Paul Masser (XVI)** is currently working on solar photovoltaic energy conversion at Motorola, Inc., and living in Scottsdale, Ariz. . . .

Edward J. Schickli, Jr. (IV-A) has been a partner in Tafel-Schickli, Architects and Engineers, since 1961. Ed gave up city living in 1978 and moved to a farm just east of Louisville. . . . **Robert L. Titus (VI)** is currently marketing manager at the Distribution Equipment Division of Crouse-Hinds Co. in Earlsville, Va. . . . **Claude D. Tapley (XIV)** is technical director — metal products for the Eltek Corp., Larchmont, N.Y.

Harris B. Stone (XIV) director of the research and development plans division in the office of the Chief of Naval Operations at the Pentagon, is involved with the Navy's mammal research program and has received the Navy's highest award, the Distinguished Civilian Service Award. He is a native of New York City, active in the Jewish War Veterans organization. . . . **James J. Bennett (XV)** is presently vice president and general manager (chief operating officer) of BIO RAD Laboratories in Richmond, Calif. Jim is now living in Lafayette, Calif.

Lawrence Gould (VIII), president of M/A-COM, Inc. of Burlington, Mass., recently spoke before a

delegation from the newly formed Chinese Academy of Social Sciences attending a seminar at the Sloan School on the management of large enterprises and on the general subject of social science research. The delegation, which was on a month-long visit to the United States, was the first to come to the U.S. from the People's Republic of China specifically representing the social sciences and humanities.

George H. Dickson (XIV) was recently named vice president for electrical engineering for Wood and Associates, Inc., consulting engineers in Seattle, Wash. — **J. T. McKenna, Jr., Secretary**, One Emerson Place, Apt. 11H, Boston MA 02114

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Bill Cavanaugh (Course IVA) will complete his second year as president of the National Council of Acoustical Consultants, an international organization with over 75 firms representing well over 300 consultants in this growing field.

Beatrice Paipert (Mrs. Julius Finn) died on April 15. Beatrice's talent in the fine arts transcended many fields. She danced and acted at the Loeb Theater and many summers at Provincetown and was an accomplished artist and sculptor. Her portrait sculpture studies included the late Norbert Wiener, Minor White, and former M.I.T. presidents James R. Killian, Jr., and Julius Stratton. She was a teacher at Beaver Country Day School and Wellesley College, and educational director of the International Garment Workers Union. She is survived by her husband Julius and son Peter.

Marvin L. Baker (Course X) reports that he has been managing Shell's elastomer business for the past 2½ years. His son Ted is completing his first year at M.I.T. Marvin affirms the statistics that one has to be further ahead to survive at Tech today than in our era.

Christian C. Bolta is working at Argonne Lab on safety research for the fast breeder reactor program. His wife (an M.G.H. woman) and he get back to Nova Scotia each year. . . . **David Findlay** and his wife Frances have started and are running a wholesale art needlework supply business. Their son Bruce completed his second year at M.I.T. in 1979. . . . **Edward A. Handy** continues his work as block grant coordinator for the City of Cambridge, Mass.

Walter E. (Mike) Johnson III is manager of the metallurgy laboratory for G.E.'s major appliance business group in Louisville, Ky. He recently completed a term as national trustee of the American Society for Metals. He extends his regards to the 49-50-51 baseball team. . . . **Morley Kahn (Course XB)** is a partner in Component Marketers, Inc., sales representatives for stereo equipment in Metropolitan New York. He and his wife Yvette live in Greenwich, Conn., with sons Adam (13) and Benjamin (10). Morley is a member of the Greenwich Representative Town Meeting. . . . **William A. Krampert (Course XVA)** reports he has spent the past year directing a management study of water and sewerage utilities. He expects to be back in Chicago this year.

Larry Kuszmaul reports that he is progressing through life similarly to the rest of us as reported in our alumni notes: "Nothing." Send in your successes boys; we don't want Larry to lull himself to sleep!

I visited Carol and **Dick Reedy** at his granite rubble stone manse with 500 yards of unimpeded view of the Atlantic on the Gloucester coast last weekend. They really know how to make it painful for the land-locked Iowan. Daughter Marcia is working in Boston. Allan (Phi Beta Kappa, University of Wisconsin, 1979) is on the way home. Cindy is now about to start her junior year at M.I.T. (worse jock than her old man — and better, too). Only Allison (13) is at home. It must get lonely in a seven-bedroom house. Reedy — (Larry, as far as I know) arrived at M.I.T. with two pairs of shoes, but couldn't find one, which left him with a pair and one half.

Sam Rubinovitz, our esteemed secretary, was elected vice president of E. G. and G. with responsibility for the Electron Devices Group.

Most recently he served as general manager for this group's planning and sales activities and the coordination of technical and administrative efforts. The group included E. G. and G. Electro-Optics Division, a major producer of flash sources and light measuring instrumentation, and E. G. and G. Reticon, a leader in the development and production of solid-state, image sensing components and noncontact measurement systems. E. G. and G., Inc., was founded in 1947 and today employs nearly 15,000 people worldwide. The firm is a technologically diversified organization based in Wellesley, Mass. and involved in environmental, bio-medical, and energy-related research, equipment and services. It also manufactures and markets scientific instruments and electronic and mechanical components.

L. A. Schneck (Course II) is a manager of resources utilization at Sperry Ship Systems, Alexandria, Va. . . . **Art Wasserman**, Sheila reports, is now living near London, England, where Art is head of Allis Chalmers subsidiary there. They have been skiing in Switzerland and Scotland and will be off to Scandinavia in August. . . . **Dr. Walter I. Wells** is presently site manager of Millstone Hill, and a group leader in Division 9, Lincoln Lab. His daughter, a Boston University graduate, is a nurse with two boys and his son Gregory entered graduate school in 1979.

Fred Weitz was elected vice president (president elect) of the Des Moines Chamber of Commerce and is chairman of the selection committee for a new president and director of Simpson College, Indianola, Iowa. Fred manages one of the oldest construction companies in the U.S. (founded in 1855) and yet one of the most progressive. He established a new open shop concern — Vulcan Construction Co. in 1975, now in the top ten in the state of Iowa in volume. He also runs an organization which plans, develops, finances, and manages homes for the aged nationally. Some current projects are in New Haven; Pompano Beach, Florida; Tempe, Arizona; St. Louis; Kalamazoo and Jackson, Michigan; Dayton and Columbus, Ohio; Hendersonville, North Carolina; Denver, Colorado; etc. He and his wife Emily have four children.

Dexter C. Whittinghill, Jr., reports that he left Underwood after seven years and joined Nashua Corp., Nashua, N.H. as manager of industrial engineering in February, 1978. Nashua is a leading manufacturer of paper products, copiers, computer disks, tape, photo finishing, etc. He needs industrial engineers!

John W. Wright died last November in a tragic Thanksgiving holiday accident which also took the life of his daughter Marion, who he was driving home from Franklin and Marshall College in Lancaster, Penn. John was head of the wave dynamics section at the Naval Research Lab. He was a recognized authority on the physics of ocean waves. He is survived by his wife Frances and son Fred A.

Paul F. Sanders was elected state representative (48th legislative district — Bellevue, Wash.) in November, 1978, for his second term! . . . **D. F. Kaufman** is doing consultation for new energy systems and offering taxpayer assistance for internal development services. — **Sam Rubinovitz**, Secretary, 3 Bowser Rd., Lexington, MA 02173; Assistant Secretaries: **Gregor J. Gentleman, Jr.**, Swanson Gentleman, Inc., 818 S.W. 9th St., Des Moines, IA 50309; **Mark Franklin**, Alton Litho Printers, 362 W. Garvey, Monterey Park, CA 91754; **Paul H. Grady**, 16 Brook Ln., Westport, CN 06880

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I have quite a few news items. The Class of '53 is doing all right. For those of you who send notes through the Alumni Fund envelopes, keep up the good work. They do get to me; however, do me a favor and print your name so I can get the spelling right. Clarity is next to godliness in the notes and nothing is worse than to have your name spelled incorrectly when someone is saying something good about you!

Rajendra Navavati has had his book *Semicon-*

ductor Devices published by Intex Publishers in 1975. . . . **Wilson Rownd** reports that he is Manager of Construction Services of Engineering Sciences, Inc., an environmental engineering firm in Arcadia, Calif. His responsibilities are corporate but he works with the Midwest Region Headquarters in Cleveland, Oh.

Sid Gravitz is working at Boeing Aerospace as Flight Operations and Software Manager on the Inertial Upper Stage-to-Spacecraft Integration Program.

Zane Yost reports he has had his own architectural firm since 1963. He has been involved in multi-family housing throughout New England.

Richard Mandel is President of Trailer Corporation of America, Chicago, Ill., which manufactures specialized truck trailers. He is also active in local politics and has been elected Village Trustee in Glencoe, Ill.

Bill Fowler has recently completed five years as an exploration consultant to the petroleum industry. I'll pass up the opportunity to make a wise remark about the gas lines.

George Michel Jr. was elected Vice Chairman of the Board and Chief Financial Officer of Stanadyne, Inc.

I recently noticed in the newspaper that the Gossamer Albatross successfully flew across the English Channel under human power. As reported in an earlier column, **Mort Grosser** will be writing the authorized book on the Gossamer Condor and the Gossamer Albatross: good luck, Mort.

Fred Brecher sent me a long letter with lots of news about class affairs (the public kind). As most of you know, Fred was elected class President at the reunion last year (how fast a year goes by). He attended the Class of '54 reunion and renewed many old acquaintances in early June. While at the "Pops," he met **Paul Shepherd** and **Howie Stern**. Paul had come East for his son's graduation from Harvard. Howie was in town to exhibit cancer examination equipment at the Gynecological/Obstetrical Convention.

During the last year, Fred has had lunch with **Dick Scott**, who is working on Solar Energy Devices for RCA at Camden, N.J. and also with **Frank Turcotte** who is working in the Purchasing Department of Turnor Construction Company in Philadelphia. Frank is working on contracts to construct the new convention hotel that Fred's firm designed for the Franklinton Development in Philadelphia. Fred's firm, by the way, has grown to 70 people, and was honored by the National A.I.A. as "Firm of the Year." Fred and Sandi and Fred's partners journeyed to Kansas City to receive the award.

For those of you who are interested in contacting me when in Washington, I'm on the move again (got to keep the kids confused). (Speaking of kids, son David has graduated from M.I.T. and daughter Eileen has graduated from Drew University; down to one or possibly two in school now.) I'm expecting to move to Watergate in Alexandria, Va. before these notes are published. If you try to get in touch with me, just call Alexandria information. — So long 'til next time, **Gil Gardner**, Secretary, 3400 Rusticway Ln., Falls Church, VA 22044

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George W. Brown has left Turner Construction, Chicago, and established his own Brown Engineering and Technology firm in Downers Grove, Ill. His firm specializes in product design related to the use and sales of thermosetting resins. . . . Another classmate entrepreneur is head of **Irving R. Silver**, Associates, an economic consulting firm in Ottawa. Irving got his Ph.D. in urban studies from M.I.T. in 1969, and has been with Informetrica in Ottawa. . . . Still another of our vintage with his own letterhead is **Gideon Gartner** of the Gartner Group. Gideon left his partnership at Oppenheimer & Co. to form this investment research firm specializing in computers, communications and office systems, serving institutional investors and vendors.

Marc Forest is with the Detroit Diesel Allison Division of GM as administrator of international projects. He travels mostly in Latin America and the Far East; and is active in the M.I.T. Club of Detroit. . . . **Sigurd Hoyer-Ellefson II** is vice president of the Patten Instrument Co. of Plainview, N.Y. He completed his Sc.D. in mechanical engineering at M.I.T. . . . **Matt Barrett** got his Ph.D. in chemical engineering from the University of Maryland and is now with the Department of Energy. He is technical coordinator of a program for converting coal to liquid fuels. . . . **Charles Berg** taught at M.I.T. where he completed his Sc.D. in mechanical engineering, and was chief engineer of the Federal Power Commission. He now teaches part-time at Dartmouth College. In a newspaper account of his remarks last April, Berg claimed the deregulation of oil prices was long overdue, and was critical of the various government energy programs. He feels the oil companies are much more effective than the government in developing new energy sources, if only Congress would reduce taxes and regulations. . . .

Robert Santos was promoted to assistant vice president for Data Systems at AT&T. He lives in Allendale, N.J. . . . **Richard Johnson** was recently named manager of systems analysis for Boeing Military Airplane Development in Seattle. — Co-secretaries: **Bruce Budehoff**, 7100 Lanham Ln., Edina, MN 55435; **Warren G. Briggs**, 33 Bancroft Rd., Wellesley Hills, MA 02181, (617) 235-7436

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Everything falls into place if one has patience. Here I am writing the last column in my term as secretary with the mailbag overflowing and the class just having completed its most outstanding reunion if not the most successful 20th in Tech's history. First to the mailroom.

The academic scene notes **Richard Huguenin** as professor of astronomy at the University of Massachusetts in Amherst and director of the Five-College Radio Astronomy Observatory. . . . **Robert Kenefick** is professor of physics at Texas A&M. . . . **Miguel Colina**, who traveled from Peru to the reunion, is head of the electronic department at the National University of Engineering and executive vice president and director of the National Regulatory Organization of Telecommunication. . . . And the perennial golfer, **Ron Rosenberg**, who again walked away with the reunion golf trophy at Essex County Club to the chagrin of **Jack Fischer** and **Joe Mogilner**, is professor of mechanical engineering in the areas of system dynamics and control at Michigan State University. Ron noted that the school won some basketball games last year!

The world of industry brought news of **Harold Smith** who, after almost twenty years with McDonnell-Douglas, has moved to Aerospace Corporation as a member of the technical staff in the program office for space shuttle implementation in California. . . . Another member of Aerospace Corporation, based in D.C. and also a participant in the 20th, is **Richard Hall** who is actively involved in support activities to the Department of Energy and their program on electric and hybrid vehicles. . . . **Syl Minter** sends best wishes to the class on our 20th and noted that he is with I.B.M., managing very large-scale integrated circuit (V.L.S.I.) design activities and preparing for the onslaught of college expenses as the first of his three children is about to start.

Ken Kreider has been named chief of the thermal processes division of the National Engineering Laboratory of the National Bureau of Standards. . . . The loyal Bronco fan, **Bob Polutchko**, is now project director for special programs at Martin Marietta in Denver. Bob noted that he had recently seen **George Snyder** — about whom we received a press statement from Dravo Corp. in Pittsburgh that he was appointed manager of the Lectro Quip department, which markets electrical processes and equipment for industrial water treatment. . . . **Bruce Newell** is with Sylvania in Massachusetts and works on gas discharge light sources. . . . **Bill Van Tassel** writes

from Lewiston, N.Y., that he infrequently sees **Kent Kresa**, **Greg Hofmann** and **Charlie Baker**. Bill is with the high-energy laser department of Textron's Bell Aerospace. Another of the Burton House party clique is **George Luedeke** who writes from San Diego, where he is manager of operations analysis at Rohr Marine.

David Moffett is now group leader of experimental operations of the Z6S accelerator at Argonne National Laboratory. . . . **Robert Clark** is on assignment from the federal government to Tenneco for one year under the President's Executive Interchange Program. . . . Other travelers include **Donald Spiller** who finished a two-year hitch in Japan for I.B.M., traveled home the long way through Nepal, Egypt and Portugal before settling in Connecticut and is now international account program manager for the general systems division of I.B.M. . . . **Bob McAuliffe** not only serves as director of systems and building engineering for American Can but gets much flying time in their Gulfstream II with visits to construction sites in the States, England and Venezuela. He is so proficient at travel that he left Caracas on Friday morning in time to have an emergency landing en route and made the reunion dinner at the Museum of Fine Arts just before we moved the bar! . . . Another reunion attendee who also sent some mail was **George Connor** who will continue in command for the Army in Crane, Ind., until next June. After **Phil Richardson's** son knocked me off the backgammon board at Essex, George showed us how to really play the game!

Dave Pawliger notes that he continues his private medical practice in internal medicine, hematology and oncology and participates at the University of Florida School of Medicine as a Clinical Assistant Professor. . . . A recent clipping from *Who's Who in Finance and Industry* notes **Calvin Campbell**, president of Goodman Equipment in Chicago, manufacturers of mining and tunneling equipment. . . . The Rand Corp. announced that **Walter Humann** was recently elected to their board of trustees. Walter and his family stopped at the reunion on their way to Europe. In addition to his active schedule in civic affairs in Dallas and his responsibilities with Hunt Investment and Hunt Oil, Walter was elected a regional vice president of the class. All this as an introduction to a few words about our 20th.

Many kudos to our new class president, **Art Collias**, who masterminded a great weekend during which there were over 80 classmates who attended, over 150 at the dinner at the Museum of Fine Arts with our guests, the Strattons, and over 200 at the clambake-outing at Essex County Club. The buffet and entertainment at Historical Collections on Saturday night will be remembered as one of those parties which lifted the roof — and then gently lowered it back into place. The spirit, excitement and the pleasures of old and new friendships were infectious. For the many who were unable to come, we hope that you have an opportunity to talk to or hear from those who did and then start your plans for 1984! For all of you, please help out our new secretary, **Larry Laben**, by keeping his mailbag filled. Let me close these five years of notes with two items.

Our new class officers, in addition to those mentioned above, are **Chuck Staples** — 25th reunion chairman, **Phil Richardson** — class agent, **Dick Sampson** — treasurer, and our regional vice presidents: **Adul Pinsuvara** in Jakarta, Indonesia; **Bob McAuliffe** in New Jersey; **Bob Muh** in Los Angeles; **Don Tyra** in Orlando, Fla.; **Dave Packer** in Boston; **Marty Zimmerman** in Chicago; and your truly as executive vice president.

This leads to the last item, our class questionnaire. There were 181 replies out of the current class listing of 725 members. With the assistance of the computer facilities at United Computing (through **Chuck Staples**), all the data have been tabulated and some cross-tabulations have been run. All reunion attendees received a copy of the results and we are mailing copies to those who sent in dues to assist the class financing of the reunion. I close with an offer to those who may be interested in receiving a copy of the results — we will forward a copy of the results to those who did

not attend the reunion or forward dues if your request is accompanied by a pre-stamped and pre-addressed return envelope and it is also accompanied by a gift to the Alumni Fund to help start to build the 25th reunion gift! For future notes, remember **Larry Laben** at 310 Rockrimmon Rd., Stamford, CT 06903 — **Allan Bufferd**, 8 Whitney Rd., Newton, MA 02160

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Sheila Evans Widnall has become the first woman to be elected to chair the M.I.T. faculty. Sheila is professor of aeronautics and astronautics; her areas of expertise include the effects of turbulence, which will no doubt be helpful in presiding over meetings of the 936-member faculty. In her new post she will represent the faculty on the Institute's governing boards and will be chairman of the committee on educational policy. Sheila joined the faculty in 1964, after earning her doctorate at M.I.T. She is married to Bill Widnall, also a member of the aeronautics and astronautics faculty, and is the mother of two children.

Harold Parmelee has been elected vice president and general manager of the Boston office of Turner Construction Company, an international general contracting and construction management firm. Except for two years of service with the Army Engineers, Harold has been with Turner since graduating in Course I. He has held various positions with the company, including assistant superintendent of the Sheraton-Boston Hotel at Prudential Center and chief estimating engineer in the Boston office. . . . **Dick Oeler** has been appointed general manager for the environmental and metallurgical systems department at Air Products, Allentown, Penn. . . . **Sheldon Epstein's** year-old microelectronics service, Epstein and Berghorn, has built computerized color graphics equipment for Chevron's "creativity" exhibit, which is currently touring the country. . . . **Joe Verderber** is in charge of an A.M. International, Inc. program for batch document communications systems. . . . **John Windle** now owns and runs both State Street Consultants, Inc., and Ahmed's, a French Moroccan restaurant in Harvard Square.

In addition to his responsibilities as president of the R. W. Beckett Corp., a manufacturer of oil burners, **John Beckett** is president of Intercrossers for America, a Christian organization emphasizing prayer for our nation and its leaders. . . . **Duane Christensen** has been appointed professor of Old Testament languages and literature at American Baptist Seminary of the West, Berkeley, Calif. . . . **Paul Burrow** is now professor of physics at the University of Nebraska. He and his wife, Mary, have two children, David (11) and Gillian (2).

Ted Kraver writes that he will be finishing his studies for an M.B.A. at U.C.L.A. about the time that this column appears. Ted has been commuting from Phoenix, where he recently stepped down as vice president of the Burn Treatment Skin Bank, a business which he and his partner previously had sold to the Greyhound Corporation, Armour Pharmaceutical Division. He is looking forward to a new career in strategic planning and organizational design, with a bent toward the management of innovation and new ventures. Incidentally, I have very pleased to hear from Ted directly, and I would like to encourage more of you to do the same as I enter my final year as class secretary.

David Bushnell was named Outstanding Engineer for 1978 by the San Francisco section of the American Institute of Aeronautics and Astronautics (A.I.A.A.). Dave is a staff scientist at Lockheed's Palo Alto Laboratories and is widely recognized for his major contributions to the field of computerized structural analysis. He is an associate fellow of the A.I.A.A., an associate editor of the *A.I.A.A. Journal*, and a member of its structures technical committee. . . . **Robert White** currently divides his time between research and corporate planning at Xerox's Palo Alto Research Center. His second book, *Long-Range Order in Solids*, written in collaboration with T. Gebalk, has

just been published. . . . **Morris Salame** is manager of research in the New Product Development Department at Monsanto, where he is working on barrier polymers. . . . **Ed Aron** is principal engineer at Raytheon Corp. for an air traffic control system ordered by the West German government. . . . **Larry Martin**, still with Xonics, Inc., in Van Nuys, Calif., and his family recently had an enjoyable visit with **Alan Starr** and family in Great Falls, Va.

Richard Smith is completing four years as a member of the Dallas City Council. He plans to return to his law practice with Gardere, Wynn, Jaffe, and DeHay. . . . **Barry Rein** is a member of Pennie and Edwards, a firm that is active in the fields of trade secret and patent litigation. He is a member of the M.I.T. Educational Council, is married, has two daughters, and is living in Manhattan. . . . **Gerald Hornik** is senior product development manager for the commercial products group of Digital Equipment Corp. in Merrimack. Gerald was founder and vice president of S.E.T.S., Inc., a computer service for schools in the Boston area, and he has taught computers at several educational levels. Gerald lives in Hollis, N.H. with his wife, Betsy, and their three children, Laura, David, and Joshua.

As I contemplate this weekend's gas-pump-jumping drive to Cape Cod, I am reminded that our 20th reunion is now less than a year away. Plan ahead; put your Senior Week beer mug to good use in salting away a little gas each week so that you can return to Cambridge in style. — **Robert F. Stengel**, Secretary, 329 Prospect Ave., Princeton, NJ 08540

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Several clippings indicate that politics is alive and well in the class. Last March **Charles George**, who has five kids in the local school system, ran for the Interlakes, N.H. school board. He campaigned on a pledge of improving the atmosphere between parents, teachers and administration to "eliminate morale and discipline problems." We have not heard how Charles did and await word from the north. . . . Meanwhile over in Groton, Mass., **Ed Strachan** was running for selectman. Ed was tackling an almost impossible job since he was challenging the current chairman of the board of selectmen, a lifetime resident — while Ed is a recent arrival, having lived there for only 12 years (a pittance so far as these old New England towns are concerned). The election was last April and I haven't heard the results of that one either. . . . In the realm of professional politics **Harold Heggestadt** is running for committeeman of the Boston section of the I.E.E.E. Harold works at MITRE where he works on the automation of the N.A.S.A. Ground Spaceflight Tracking and Data Network. . . . Over in industry, where they tell me that politics is also important, **Sanford Weiner**, who is the advertising manager of a division of Proctor and Gamble in Cincinnati, is moving up to become the manager of the bar soap and household cleaning products division. Congratulations, Sanford. . . . Finally over at IBM, at the data systems division in East Fishkill, N.Y., **Dan Schnurmans** had a promotion to senior engineer. Dan, wife Miriam and their three kids: Esther, Debra, and David live over on Dunhill Lane in Monsey, N.Y.

There was an interesting editorial in *Science* magazine last May by **Richard Meehan** who is the president of Earth Sciences Associates in Palo Alto. The editorial, which caused quite a bit of comment around here, points out the fallacy of thinking that a better informed public would come to rational conclusions about matters such as the Three Mile Island accident. Since there does not appear to be a consensus of opinion among the experts it seems unlikely that the public could ever achieve one either. Dick goes on to say that "the nuclear safety issue is more of a quasi-religious than a technological conflict" and that "widespread improvement of scientific literacy is unlikely to improve matters." I commend the editorial to you all. It is in the May 11 issue.

Another department chairman in the class is **Malvin Teich**, head of electrical engineering at Columbia. First M.I.T., then Columbia, then the world! Mal had been at Columbia since 1967. When not administering he is working on detector theory, laser communications, and sensory perception (especially auditory and visual) with some friends at Columbia's College of Physicians and Surgeons. **Jerry Grossman** is moving up too. He left Mass. General Hospital the other day to become the head of New England Medical Center, which is the teaching hospital for Tufts Medical School in Boston. Wow, very impressive! Other honors collected by members of the class include a Guggenheim Fellowship to **Steve Kleiman** of the M.I.T. math department. He is off to study enumerative geometry. **Sam Williamson** is off to France this fall on a sabbatical at the University of Paris at Orsay. He is being helped by a Fulbright Senior Research Fellowship. He writes that he "expects to enjoy the Bohemian life of the Left Bank when not engaged in research on spin glasses, superconductivity, and neuromagnetism." **Paul Schweitzer** is Professor at the University of Rochester Graduate School of Management, after completing five years at the IBM Watson Research Center. His current interests include telecommunications systems and distribution systems. **William Robinson** writes that he has had nearly as checkered a career as your class secretary. He got his Ph.D. at Purdue in 1967, then was a post-doctoral fellow at the University of Wisconsin until 1972. Then off to Washington as a staff fellow, then a research biologist, then a visiting scientist, all at the N.I.H. until this year. Finally (whew!) Bill has found a home at the Johns Hopkins Medical School as an assistant professor. Now he can struggle with the rest of us for nirvana — tenure.

In the industrial sphere of life **David Roberts** writes, "I am now Vice-President of Optical Engineering at Cleveland Crystals, Inc., which I helped found in 1973. Now in our sixth year, we have supplied about 75 percent of all large aperture laser Q-switches in the U.S.A. and several foreign countries for research with laser-induced (inertial confinement) fusion. I have also been engaged in consultative work and spend some time rebuilding pianos. I will be teaching a class in piano stringing scale design at the Piano Technicians Guild national convention this summer." **Ira Dorf** is "now director of executive and expatriate compensation for I.T.T. I also am teaching in an M.B.A. program for Adelphi University's school on wheels program where degree courses may be taken while commuting on the various N.Y. metropolitan commuter railroads."

Even more news from the industrial world: **Parvin Lippincott** says that he still lives in Richland, Wash., and is still working for Westinghouse at the Hanford Research Facility. He is doing research and development on fast breeder reactors. Parvin's family now consists of his wife, Sharon, and their three kids of ages 12, 10, and 7. . . . **Gilbert Stegen** is the manager of S.A.I./Northwest, a division of Science Applications, Inc. Not long ago he was upgraded to Assistant Vice President. He writes that he loves living in the Northwest (Seattle).

Ben Turetzky used to be Town Council President in Parsippany-Troy Hill, N.J., but couldn't hold that job when Texas U.S. Chemicals moved him down to Port Neches, Texas, where he is now Senior Research Scientist. **Pete Gaposhkin** writes that: "I am now working for Informatics as a programmer on the CPC 7600 at the Ames Research Center. The present project I am working on is a research project on plasmas in the atmosphere of Venus." **Fred Schmidt** wrote to say that he is now the Engineering Manager for Bermite in Saugus, Calif. He says that he has been in the ordnance/small rockets business for the last six years.

Finally there are some new kids on the '61 scene. **Tony Lewis** is the father of Alice, born in May (as I recall). Most of his friends thought they never would see the day. Congratulations to Tony and Susan! Tony writes technical type stuff for Prime computer and is very good at it. **Virgil Vickers** wrote that: "I am enjoying being the father

to my 2-year-old daughter Rani (From India) who is just terrific in all possible ways."

It was wonderful to hear from all of you this month. Please keep writing and keep us all informed. — **Andrew Braun**, Secretary, 464 Heath St., Chestnut Hill, MA 02167

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Don Horner is living in San Diego and is program manager for Cubic Corp. . . . **Kenneth Rahn**, a research associate at the University of Rhode Island Graduate School of Oceanography, conducted a discussion on Arctic pollution at U.R.I. . . . **Dr. Robert Lee Covey** is now Senior Physicist with Perkin-Elmer Corp., Norwalk, Conn. . . . **Ted Sheskin** is Assistant Professor of Industrial Engineering at Cleveland State University, Cleveland Oh. . . . **Dr. Elliott J. Bayly** has started the Whirlwind Power Company, Denver, Col., manufacturing wind-electric generating systems. . . . **Bardwell C. Salmon** has been appointed to the position of Vice-President, Small/Medium Systems at Honeywell Information Systems. . . . **Warren M. Zapol**, now Associate Professor of Anesthesia, Harvard Medical School at Mass. General Hospital, was called to Moscow where he saved the life of an academician's daughter who was stricken with septicemia and pneumonia.

I would very much like a volunteer to take over the position of Class Secretary, since I've performed it now for 17 years. Please write — you might enjoy it. — **Gerald L. Katell**, Secretary, Seven Silverbit Lane, Rolling Hills Estates, CA

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Sorry to miss the June/July issue, but last month's deadline caught me while I was traveling. I had the opportunity to visit the People's Republic of China where I made a number of presentations regarding x-ray thickness and coating measurements, and computer control systems for galvanizing lines and rolling mills. The Chinese are building an enormous steel mill near Shanghai, and my company, Nucloonic Data Systems, is bidding on some of the measurement and control systems for the galvanizing lines. My stay in China was most interesting, and I think I raised a few eyebrows jogging through the streets of Shanghai in a bright red M.I.T. shirt.

Another classmate recently returned from the Far East is **Brian Strong**, although his stay in the Orient was much longer than mine. Brian was working in Tokyo for I.B.M. Brian, Nancy and their three children recently moved to Westport, Conn. He is Industry Manager — Banking, for the Far East. While in Japan Brian sponsored several Japanese who are now attending M.I.T.'s Sloan School. . . . Closer to home, **Richard Ludeman** is involved with the start-up and commercialization of the largest Hemi-Hydrate Process phosphoric acid plant at Occidental Chemical.

Elliot Bird is chairman of the Math Department at C. W. Post College on Long Island. He appeared on the program of the annual meeting of the National Council of Teachers of Math in Boston last April 18-21. . . . On May 1, **Bob Morse** became a partner in the Washington, D.C., law firm of Peabody, Rivlin, Lambert and Meyers. Prior to joining the law firm Bob had spent seven years as a senior litigator with the Antitrust Division of the Justice Department. . . . **R. W. Morris** writes that he is living with his son Alan and daughters Beth and Rachel in a badly used but refurbishable late Victorian house in Pennsylvania. He is teaching biology at Widener College and having a good time. Right on!

Mark Grebler recently married Marilyn Miller of Rochester, N.Y. Mark continues in the importing business with classmate **Bernd Hopp**. They have just diversified into trading rare U.S. stamps and would be happy to hear from alumni interested in stamps. . . . Every Sunday the *Los Angeles Times* publishes a magazine section called *Home*. One feature of the section is called "Guys and Gallies." The February 11 issue featured **John Holly's**

Brantley Peppers. The article showed a picture of John at work in his galley and described his twice-yearly buffet dinner parties. "When it comes to food, I love to experiment," John was quoted as saying. "I'll marry ingredients most cooks wouldn't dream of. For instance, I came up with a sourdough bagel that's really different and good." (They never served that at commons.) John heads his own consulting firm and calls himself a "human factors engineer." John even has his own "tasting laboratory" — a friend with four children — and he cooks everything from fancy breads to fancier desserts.

Ken Klein is currently Director of Research at KRON-TV in San Francisco. He spent the last 2½ years in a similar position at KGO-TV, also in San Francisco. He became a private pilot last September and he flies every weekend. The perfect culmination of training in Course XVI. . . . **Bob Efimba** has been appointed to the eight-member Architect-Engineer Evaluation Board of the Pennsylvania Avenue Development Corporation. The A.E.E.B. advises P.A.D.C. on the selection of architectural and engineering firms to design projects in the Pennsylvania Avenue Development Plan. Bob is Assistant Professor of Civil Engineering at Howard University in Washington, D.C. That makes my news current as of last March. Don't despair — your notes will eventually make it into print. — **Mike Bertin**, Secretary, 18022 Gillman St., Irvine, CA 92715

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Greetings '64. Guess who's back at his same old stand (at least for another five years' worth). After some prepared remarks like "if nominated I shall not run" and "if elected I shall not serve," the nominating committee, in the person of silver-tongued **Dick Carpenter**, convinced me I'd be crazy to pass up a chance for five more years of this. So here I am again, hoping the class will be as pleased with the results as I am to have been chosen to produce them.

For those of you who missed the great Fifteenth (which was most of you), we who attended missed having you there. At one time or another during the weekend, forty or so classmates appeared and variously participated in the several events. In no particular order and with little assurance of accuracy, these hearty souls were **Sandy and Michael Auerbach**, **Sharon and Art Best**, **Ed Casper**, **Dave Fahrland** and **Lu Seiler**, **Barbara and Alan Gamse**, **Steve Glasman**, **Ellie and Glenn Larson**, **Karen and Bob Popadic**, **Mark Radwin**, **Linda and Bill Roberts**, **Sue and Dave Saul**, **Marlene and Steve Schlosser**, **Susan and Len Theran**, **Barbara Pollack**, ('66), and **Carl Uhrmacher**, **Dave Weitzler**, **Linda and Bill Young**, **Sherry and Joseph Coldwell**, **Lee Geddes and Jason Fane**, **Sandy and David Freedman**, **Joan and Mark Lappin**, **Jim Monk**, **Geoff Nelson**, **Marlene and David Sheena**, **Bruce Strauss**, **Ellen and Gary Walpert**, **JoAnne and Dick Carpenter**, **Susan and Tom Cheek**, **Diane Spencer** and **Bob Scott**, **Susan and Paul Berget** (with an attendance question mark after their names on my list), **Ronda and Frank Berkman**, **John Timoshenko**, **Dave Morrison**, Mr. and Mrs. **Larry Seligman** (to whom I apologize for having forgotten her name). If I have left you out, please advise and I will gladly make restitution in some future issue.

Many of the above-mentioned individuals brought their children along. And for the children, M.I.T. had prepared a truly outstanding program. Our kids (intended both personally and collectively) were assigned rooms in Baker House, mostly on the first floor — roachless I presume (unlike their parents' rooms in Burton House). The youth program included a magic show, square dances, a pizza party, a boat ride and clambake (including lobster), phone calls to parents at 5 a.m. (our George "cracked" the interdorm calling system), pinball machines (yes, pinball machines!), etc. After that brief hesitation which accompanies any separation of relatively young children from their parents, there was a rapid transition to the attitude that parental concern was a superfluous nuisance

("Don't bother us, Mom." "We're fine and having a good time and loving every minute of it." "Can we have the same rooms next year?" "Do we have to wait until 1984 for the next reunion?"). The kids seemed delighted.

Our part of the reunion was also fun. Starting with Tech Night at the Pops (at which we had a '64 alumnus, **John W. Miller**, as a soloist — more about John later), Friday's Technology Day program provided time to wander around the Tute, Cambridge and Boston. Friday evening, the Hospitality Lounge at Burton's Rathskellar was the first social gathering together. Saturday, after breakfast, **Bill Roberts** and I checked out some sports equipment for the afternoon's fun. Lacking a volleyball net (more specifically, lacking the poles — nets were available), our traditional volleyball game was cancelled in favor of softball. We had a rousing one-inning game (about one half-hour's worth) with several home runs and much offensive action by both sides. Following the game, a delicious catered picnic lunch buffet was provided. Some unproductive attempts were made to reestablish athletic activities for the afternoon, but most of us drifted in small groups to "do our own thing." Saturday evening's festivities — cocktail party, buffet dinner, and dancing, all at the beautiful Hyatt Regency — were well attended, delicious (the food), and fun (the dancing and socializing).

Sunday's locale, the M.I.T. Historical Collections, was fascinating. I particularly enjoyed the time trace of Institute facilities development in Cambridge, a collection of photographic enlargements running from about 1929 until the present date. The other memorabilia and artifacts make this a must-visit place (don't be turned off by appearances from outside the building); I don't remember such a facility from our time, and it's terrific. The business at hand for Sunday was election of Class Officers (after brunch), and elect we did, and elect, and elect, and elect. . . . President, **Dave Saul**; Vice-Presidents, **Bob Scott** (with special assignment to act as local contact for the Class Agent), **Carl Uhrmacher** (with special assignment to do Twentieth Reunion Advanced Planning), **Mark Radwin** (procurement, hmmmmmm. . .), **Bob Popadic**, and **Bill Roberts** (each of last three with special assignment to generate enthusiasm and support for Class activities and improved Class communication in their respective geographic areas); Class Agent, **Steve Glasman**; Secretary, **Steve** (and Marlene) **Schlosser**; Treasurer, **Bruce Strauss**.

Special thanks were acknowledged to **Dave Saul** for his leadership and energy in planning and arranging our Fifteenth. And then we adjourned, said our goodbyes, and went our separate ways, probably not to see each other again for another five years (as seems to be the case for most of us between reunions). I don't think we established who came the farthest. **Geoff Nelson** lives about 1000 feet west of **Mark Radwin**, giving him the absolute distance record. However, **Joe** and **Sherry Coldwell** came the farthest (Tulsa, Okla.) specifically to attend our Fifteenth, whereas **Geoff** and **Mark** were able to tie their visits in with business trips. The newest baby — belonged to **Dave** and **Cindi Morrison** (Meaghan Ann, born 6/1/79), though earlier in the weekend I thought that distinction would belong to either the **Bests** or the **Popadics** (based upon personal observation, naturally). As Secretary, I garnered one extra advantage from the reunion: lots of news to fill at least a couple of columns worth. I'm not suggesting any of you stop writing; I'm only saying we have a plentiful supply of news for a month or two or three. Let me close off with the press release from the M.I.T. News Office about our class hero soloist, **John Miller**:

"One of the highlights of Technology Day this year was Tech Night at the Pops, featuring alumnus and principal bassoon of the Minnesota Orchestra, **John W. Miller, Jr.**, as soloist. John, the only M.I.T. alumnus ever to hold a principal chair with a major symphony orchestra, performed von Weber's Bassoon Concerto in F. Major, Opus 75.

"John received the S.B. degree in electrical engineering from M.I.T. and the Master of Music

degree and Artist's Diploma from the New England Conservatory. He received his early music training at the Peabody Conservatory in his native city of Baltimore. During 1964-65, he was a Fulbright scholar at the Muzieklyceum in Amsterdam, and in 1966 he won first prize in the annual Pi Kappa Lambda competition sponsored by the New England Conservatory's chapter of the national music honor society. In 1968, he won the Erwin Bodky Award for Interpretation of Early Music given by the Cambridge Society for Early Music.

"In addition to his performances with the Minnesota Orchestra, John has also appeared as soloist with the Baltimore Symphony Orchestra, the Netherlands Chamber Orchestra and the Boston Philharmonia. He was the founder and Musical Director of the Boston Baroque Ensemble, played first bassoon in the Boston Philharmonia Chamber Orchestra, and was a member of the Philharmonia Wind Quartet. He was on the faculties of Boston University and the New England Conservatory of Music until 1971, when he assumed his present position with the Minnesota Orchestra." — **Steven Schlosser**, Secretary, 11129 Deborah Dr., Potomac, MD 20854

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Our class hero this month is Dr. **David N. Smith**. Dave wrote to fill us in on the 14 years since graduation. After M.I.T., he got a master's in electrical engineering at New York University and then went to the University of Rochester Medical School. Then followed specialty training in neurology and a faculty appointment in the neurology department at Rochester. Currently, Dave will be spending a year as a post-doc fellow in neuro-ophthalmology at the Mass Eye and Ear Infirmary. David and Maria have one daughter, Elizabeth. The rest of this month's notes come from the back of Alumni Fund envelopes.

Harry Movitz has turned his landscape company over to a management group while he has turned to teaching college physics and is halfway through a mystery novel. . . . **David Lerner**, writing from Phoenix, completed his first marathon in December. Dave has "discovered the secret of the universe, but does not plan to reveal it." . . . Pat and **Domenic Giovachino** and their twin daughters, 10, have been living in Frederick, Md. since August, 1978. Both the Giovachino's work at Frederick Electronics. The four of them spend most of their free time sailing on Chesapeake Bay. . . . Diane and **Dick Schmalensee** are living in Brookline. Dick has been promoted to Professor of Applied Economics at the Sloan School. . . . Also recently promoted was **John Groves**, who is now a full professor in the chemistry department at the University of Michigan. John, Karen, and sons Jay, 8, and Kevin, 5, are living in Ann Arbor. John recently had a sabbatical which included lecture trips to Hawaii, Australia, and France. . . . **Michael Gabel** is Assistant Professor of Mathematics at George Mason University, Fairfax, Vir.

Gil Falk recently joined Codex Corp. in Mansfield, Mass., where he is involved with planning and marketing computer networking products. He recently moved from Burlington to Sharon. . . . **Kayson Nyi** was promoted to project leader in a Coatings Applications Lab at Rohm and Haas near Philadelphia. His wife Corinne finished her doctorate in physical chemistry at the University of Pennsylvania. . . . **Bruce Fauman** last year went to the University of British Columbia as a visiting professor; the Faumans liked Vancouver so much that he has decided to stay and head up his own management/marketing consulting firm. . . . Susan and **George Lee** had their third child, and first son, in January. George is working for T.R.W. on a micro-processor network project and is still active with home computers.

Barbara and **Harry Vickers** are living in Hollis, N.H., amidst dairy farms. The Vickers have two sons, Bill, 4, and Brian, born January 1, 1979. . . . **Craig Wheeler** has been a visiting fellow of the Joint Institute for Laboratory Astrophysics at the University of Colorado. The Wheelers have skied,

traveled to Mexico and Guatemala, and tried some rock climbing. Craig's work has been on exploding stars. Next fall it is back to the University of Texas. That's it for this issue. Keep writing. — **Edward P. Hoffer, M.D.**, 12 Upland Rd., Wellesley, MA 02181

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Dear Class: Last issue's deadline caught me preparing for final exams at George Washington University and finishing a contract report for my employer. Although I did tend satisfactorily to school (I graduated and now have five degrees) and to work, you undoubtedly noticed my failure to write our column. Recently, **Paul Rudovsky** wrote saying how pleased he had been to see '66 regularly represented. Paul left Citibank this February to travel (Argentina, Brazil, Bermuda, Dominican Republic, and California), help run the M.I.T. symposium in N.Y.C. on "Doing Business with China," lecture at the Sloan School, and start his own consulting firm. He is specializing in designing information systems for financial institutions and welcomes all inquiries or leads (212-888-1689). Let us hope that Paul's efforts develop into a role of leadership in the financial community for the Class of 1966.

Paul also writes that **Larry Calof** has moved to Palo Alto from Los Angeles to open a San Jose office for his law firm, and that **Elliot Green** is making a living near Berkeley consulting. **Steve Disman** and **Larry White** are still at Citibank and doing well.

Congratulations to **Sandy Sawchuk** who has a Ph.D. in electrical engineering from Stanford is now an associate professor of electrical engineering at the University of Southern California and director of the Image Processing Institute there. He and his wife Mariette are taking a double barreled lesson in baby taming with a pair of one-year-old identical twin boys. . . . **Victor Rosenberg** is showing outstanding entrepreneurship as president of Chesapeake Life Insurance Co., chairman of the board of Datatel computer sales, and consultant on systems market planning. He has four children: Michael (11), Ambriel (8), Shamain (4), and Arilim (0). . . . **Bert Forbes** is equally ambitious as president of Zintech Corp., manufacturers of microcomputer interfaces and controllers. Bert is living amidst the nuclear power plant controversy in San Luis Obispo, Calif., and has an 18-month-old son Bryn. . . . **Ralph Schmitt** is beginning his third year as vice president of operations with R. and G. Sloane in Los Angeles. He and Sandy reported loving Maui, Hawaii (Did you visit Lindberg's gravesite there?) and their kids are participating in the national rise of soccer.

Hal Helfand, like myself, is among the ever increasing ranks of people associated with hospital computer systems. He is currently an independent computer consultant developing a complete financial hospital system (Is it implemented in mumps?) for small hospitals which is just beginning to be marketed to the San Francisco area. Hal previously led a group who won a Tims Annual Award for best application of 1977 while he worked for Bechtel. Congratulations and best of luck in the medical field. . . . **Bill Thomas** has joined me in the "paper clip" building at 400 Army-Navy Drive by taking employment with the Institute for Defense Analyses and leaving the University of Houston. He is living in Vienna, Va., with his dog, two sons, station wagon, and wife, Anne. . . . **Bill and Eleanor Klepser** write that they have just set a new record of living in one house for more than three years. Bill left production to become a senior project engineer for the process development laboratory of Pittsburgh Corning Co.

Congratulations to **Fu Tak Dao** who became a naturalized citizen this year. He is an assistant professor of physics at Tufts University and earned his Ph.D. at M.I.T. Recently, he was called upon to host a science delegation from Peking that visited the Fermi National Accelerator Laboratory near Chicago. . . . **Richard Clark** is currently an instructor in the Department of Dermatology at Harvard

Medical School. . . . **David Hayes** is an assistant professor of chemistry at Union College in Schenectady, N.Y. He and Susan have one son, Paul, who is two.

By now, **Harry Moser** has joined the ranks of us, bereft of physical sense, who have endured the full 26 miles, 385 yards. In January, Harry was training for the Cleveland Revco marathon. Harry is in the part-time carpentry business: he bought an old house in Shaker Heights and is fixing it up. . . . **Ted Gull** is in the Washington area living in Columbia, Md., and working on the space shuttle and astronomical satellites at the Goddard Space Flight Center. His wife, Connie, is head nurse at Howard County General Hospital, and their two sons, Michael and Matthew, are avid soccer participants. . . . **Joe Shaffery** was recently promoted to director of the materials management for the Allen Group, Inc. . . . In January, **Marvin Sirbu** married Barbara Lazarus, director of career services at Wellesley. The services were held in the M.I.T. Chapel. **Ted Kaplan**, **Steve Disman**, and **Stuart Nemser** all helped celebrate the marriage.

Tim Connolly received his M.B.A. from Stanford this June, graduating in the top ten per cent of his class. Congratulations! Tim has worked with Spectra Physics in Mountain View, Calif., since June, 1978. He is medical products production manager and is leading Spectra Physics into the laser photocoagulator market. He attended the Alumni Center's conference at M.I.T. last October and enjoyed it thoroughly.

Barnett Wolff is still playing with computers for a living and is playing with his son David and daughter Elana Beth for recreation. His wife Erica joins in, too. . . . Carole and **Stan Horowitz** had their baby, a healthy and vocal boy. Stan is still director of the readiness and logistics division at the Center for Naval Analyses while Carole continues to give money away for N.S.F. . . . **Ray Pfau** is in his ninth year teaching junior high math and/or science in Concord, Mass. He and Peggy have three girls: twins Polly and Jenny (3) and Erika (six months). They live in apple country (Bolton, Mass.). . . . **Michael Ward** is still designing frequency counters for Hewlett Packard and published an article in the January, 1979, *H.P. Journal* thereon. — **J. Patterson**, Secretary, 1403 Gerard St., Rockville, MD 20850

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Janice and **Wayne Porter's** second son, Noah Chaim, entered the world on May 12, with Wayne serving as coach and photographer. . . . **Dave Kress** has been promoted to Manager of New Product Marketing for Analog Devices Semiconductor in Wilmington, Mass., a company he has been with for six years. . . . Emily and **Dick Gauthier** moved from sunny California to New Jersey last September to take jobs as human factors psychologists with the Bell System, Emily at Long Lines and Dick at Bell Labs in Whippany. They both recently completed Ph.D.'s in psychology at Stanford. . . . Running has become a family sport for **Larry McNichols** and family. They recently participated in a run with 7,000 other people who accepted the American Lung Association's challenge to "Get in Gear." Larry is enjoying his work in medical electronics, at Medtronic. . . . **Alan Gevins**, Director of the E.E.G. Systems Laboratory in the Department of Psychiatry at the University of California, San Francisco campus, gives his best regards to all the old tools and hackers. He is just beginning a third experiment on human cerebral macropotential and higher cortical functions.

Carl Doughty recently became employed by Sun Information Services, the computer branch of the Sun Oil Co., as a product services specialist. He attended the last annual M.I.T. Civil Engineering Alumni meeting but was sorry no other Course I classmates attended. . . . **Mel Snyder** is in private practice in neurosurgery in the South Bay area of Los Angeles. He is also a clinical instructor at U.C.L.A. The Snyders have three children and will be celebrating their 12th wedding anniversary this

August. . . **Stuart Orkin** is on the hematology staff at Children's Hospital and Harvard Medical. He is doing research on molecular genetics of human blood disorders. . . . After obtaining a union card from the Sloan School, **Steve Alter** spent three years professing business and computers at U.S.C. "Aside from publishing numerous articles — some learned and others understandable — and playing a fair amount of chamber music, my primary accomplishment was marrying the former and current Carol Banquer." They recently moved to San Francisco, and Steve founded Steven Alter and Associates, Inc., which is devoted to developing planning models, performing applied implementation research, and validating information systems. His book *Decision Support Systems: Current Practice and Continuing Challenges* is being published by Addison-Wesley this year. . . . **Bob Rosenberger** lives in Newport Beach, Calif., and works for the medical specialties and dental businesses of American Hospital Supply Corp. as Manager of Business Analysis. . . . **Don Berliner** writes: "After several years of sweat and tribulation, my book has been published. It's called *Want a Job? Get Some Experience. Want Experience? Get a Job*. And, in line with that, I got a (new) job — with the Solar Energy Research Institute in Golden, Col. in their Economics and Market Analysis branch."

Yupo Chan is still on the faculty at Penn. State. He reports that seven years away from M.I.T. have broadened his personal perspective — for example, he enjoys pulling for Penn State's No. 1 football team in a crowd of 70,000. . . . After ten years at United Technologies Research Center, Hartford, Conn., **Alan Dubin** recently joined Aerospace Corp. in El Segundo, Calif. There he manages patronage forecasting work for the Federal Railroad Administration's Northeast Corridor Improvement Program. Alan, Meredith, and daughter Elizabeth, now 8, enjoy their new home in Tustin. . . . **Murray Katcher** has been appointed Assistant Professor of Pediatrics at the University of Wisconsin Center for Health Sciences. He, Susan (Brandeis '67) and their two children like the cold Madison weather. . . . After almost 15 years in Boston, **David Olsevit** finally took a big leap and landed in Hawaii, on site assignment for MITRE Corp. Ann and **Paul Tarantino** stopped by in July. Dave will be there for another two years; anybody visiting Hawaii should get in touch. . . . **Bill Murray** is still working for Anisties, the risk management consulting subsidiary of Alexander and Alexander, except that he is now in the new Palo Alto, Calif. office. Living very near the San Andreas Fault is a risk he would prefer to do without since most of his life savings were required to buy a highly overpriced home in Portola Valley. . . . **Larry Galpin's** second daughter was born in 1977. The Galpins have moved from a renovated house to another they are now renovating. Larry is a development specialist for DuPont Engineering Plastics. . . . **Bill Caton** practices neurological surgery in Pasadena and is on the clinical faculty in the Department of Neurological Surgery at U.S.C. School of Medicine. His third child, Adam, was born in 1976. — **Jim Swanson**, Secretary, 878 Hoffman Terrace, Los Altos, CA 94022

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All right sports fans, my apologies for not keeping up with the mail. 'Twas a great reunion, complete with an evening cruise in Boston Harbor. If you missed this one, be there in 1984.

Alan S. Ratner writes: "I am currently living and working in Cheltenham, England, a cotswold town some two hours from London. I am employed by the U.S. Department of Defense's Liaison Office as Project Manager on the development of an experimental adaptive antenna system. I have been here since the autumn of 1978 and plan to do much traveling during my three-year assignment here."

Keep those letters and postcards coming to **Stanley J. Sramek** at Room 536, Hamilton Hall, University of Nebraska, Lincoln, Nebraska.

Michael Rodriguez reports that he has run his first marathon and his next goal is to qualify for the grandperson of all marathons — Boston. Lots of luck; the word is next year's qualifying time will be 2:50.

Last year **Rik Anderson** was responsible for the economic evaluations which led to United Airlines' purchase of \$1.6 billion worth of aircraft. Rik is now in United's Corporate Strategy Group. In January, Rik and wife Holly were blessed with a second daughter, Hillary.

Barry Milder reports that he practices ophthalmology with a subspecialty in pediatric ophthalmology. Beverly Milder owns the local Yamaha music school and has 90 three-to-eight-year-olds enrolled. Their daughters are Rachel, 6 months, and Rebecca, 5 years.

Don Rosenfield wrote that his wife Nancy (Liebman, '71) gave birth to their second child, Todd Andrew, on Nov. 13, 1978. Congratulations. They live in Bedford, Mass. Nancy is a system programmer at Data Resources and Don is a consultant at Arthur D. Little.

In December, 1978, **Bob Davis** left the Navy Department Comptroller's Office to join the professional staff of the House Appropriations Committee with responsibility for all military pay and allowances, training, and so forth. The annual budget is \$40 billion.

Stephen Schiffman is Assistant Professor of Mathematics at Colorado College, Colorado Springs, Colo. He is married to Lisa Schwartz (Wellesley, 1967) and they have a daughter Emma born in 1975.

John W. Spalding III has been appointed an operations officer by the Trust Company of Georgia, an Atlanta-based bank holding company. John is assigned to Trusco Data Systems, the company's statewide data processing organization. He began as a systems programmer in 1977 with the company and is now manager of TDS-Systems Support.

Christopher W. Brooks is Manufacturing Systems Manager at Schramm, Inc., and recently qualified as a Fellow of the American Production and Inventory Control Society. His wife Barb is studying nursing at the Bryn Mawr Hospital.

Bob Schaeffer writes that "after 6 years as a lobbyist for CPPAX, the Massachusetts 'new politics' citizens' group, I've 'gone over to the other side' as a policy analyst for the State Senate specializing in tax and budget issues — a booming field in the post-Proposition 13 climate." Bob is also consulting and teaching courses on "How to be an Effective Advocate" and "Proposition 13 Fever: Risks and Opportunities." He is also editing a book due out in 1979.

Thomas Najarian is busy with his study of nuclear workers at the Portsmouth Naval Shipyard (see *Technology Review*, November, 1978, p. 74). (If memory serves correctly, Tom received some well-deserved headlines for his research a few months back and testified before a Congressional committee on his findings.) He also served as Chairman for the highly successful 10th Reunion for which I'd like to express the gratitude of the class.

Peter Kleeman just completed his Ph.D. in environmental engineering at Harvard and is now "vacationing and seeking employment before my bank account is drained."

Bruce Heflinger hopes to receive his Ph.D. at M.I.T. about the time of the 10th Class Reunion.

Steve Rothman and family moved into a new home in Bolton, Mass., in August, 1978. The Rothmans' second daughter was born during the blizzard of '78, on Feb. 6. Steve is still at DEC, was an original member of the group which developed the VAX-11 architecture and is now engineering manager in the VAX CPU development group in Tewksbury, Mass. He is working with **Dave Cane**, **Dave Sittler**, Bob Armstrong, '70, and Paul Grahek, '71.

Tom White completed his residency in orthodontics at U.C.L.A. and is now in private practice in San Pedro, Calif. Tom and wife Danielle are in their ninth year of married bliss which, according to Tom, is "a noteworthy achievement in this area."

Dr. James P. Kornberg and wife Sally are enjoying their two-year-old daughter Mariah and were expecting an addition to the family in early 1979. Jim has left Arthur D. Little to establish a private practice in occupational medicine in Leominster, Mass., and offers both medical and hazard recognition services to industries which employ workers exposed to toxic substances.

James Taggart has been promoted to Assistant Director of Software by Functional Automation, Inc., of Nashua, N.H. He is responsible for design and development of firmware for all 6800 microcomputers in the F6400 Mainframe Computer System.

Jeff Weissman and wife Linda are living in Florida from whence Jeff reports "one of the side benefits of south Florida living is being able to play softball in December — something I've never done before living up north."

Rodney G. Riek and family are still residing in St. Louis. Daughter Amy was born on Dec. 2, 1978. Rod recently accepted the position of Assistant Manager of Manufacturing Services at I.T.T. Blackburn Co.

Hank Levine and wife Jodi are "finally entrenched in the practice of pediatrics in Tulsa, Oklahoma." Hank's in general practice and Jodi's assistant director of the Eastern Oklahoma Perinatal Center. Hank is also growing orchids and recently won first and second place at the Southeast Regional Orchid Show in Oklahoma City.

Steven Maser has moved from the Department of Political Science at UW-Milwaukee to Assistant Professor of Public Administration and Public Policy, George Atkinson Graduate School of Administration, Willamette University, Salem, Oregon.

William Lee Roberts reports that he received an M.B.A. at Harvard in June, 1978, and is engaged to Paula Barta who is completing her master's at Harvard this June. They plan a wedding in the M.I.T. Chapel after Paula's graduation. William is with John McMahan Associates, Inc., in San Francisco where he works in real estate consulting and investment management.

Kathryn (Kanarek) James and her husband Hugh R. James, Ch. E. '74, are living in Kansas City, Mo., where Kathy is with the Army as an Operations Research Analyst. Hugh is Business Development Manager for Pritchard Corp.

Brazos V. Guido reports that he and his wife Kathy are expecting their third child this spring.

Tom Moebus is Director of Consultation and Education for Valley Adult Counseling Service in Massachusetts. He has worked as a counselor, trainer, consultant, and administrator in the mental health field for seven years.

Russell E. Molari has been appointed a project director in the PMI Western Division of Informatics, Inc. His work involves overseeing N.A.S.A. projects at the Ames Research Center and CalTech's J.P.L. Russell was an analyst at Los Alamos Scientific Laboratory prior to joining Informatics where he has advanced from programmer to task manager and, in 1975, to project manager. He and wife Pamela live in Mountain View, Calif.

Allen W. Wiegner was awarded a Ph.D. in electrical engineering by M.I.T. in June, 1978, and married Sandra A. Waddock of Boston in August, 1978. He is continuing his research in cardiac muscle mechanics at Beth Israel Hospital, Boston.

Robert J. Randall is chief engineer at Thames Valley Steel Corp., New London, Conn. and Vice President of Thames Engineering Consultants, Inc. He enjoys sailing with his sons Chris, six, and Tim, three, on a new 26-foot sloop named *Phaedra*. Apparently wife Donna prefers not to sail.

Larry Hodes spent 1977 and most of 1978 as Research Director of ACTION-Housing in Pittsburgh. His wife Enid's editorial career pushed them on to Washington, D.C., where Larry is now a Senior Analyst with Public Technology, Inc. He monitors HUD neighborhood preservation research on behalf of the Urban Coalition.

Tom Schonhoff and wife Maria were blessed with their third child in September, 1978 — a girl (they also have two sons). Since April, 1978, Tom

has been with MITRE Corp. in Bedford, Mass.

Stephen C. Poppe has been involved in developing a numerical credit-rating technique for the last year. His comment on the experience: "Wow! Talk about disparity between theory and practice, try project management!" Stephen is also interested in skiing and snow camping as well as finishing his Ph.D. dissertation in operations research at Berkeley.

Terence M. Colligan, of Framingham, Mass., has been named Vice President of Management Decision Systems, Inc., of Waltham, Mass., a privately held national leader in the development and use of problem-solving models and computer software for business analysis and planning. He will continue to act as Manager of Systems and Operations. Terence joined MDS in 1973 as a systems programmer.

Given the uncertainties of the electoral process there may be a new Class Secretary after the Reunion. Don't all cheer at once, let me lead the claque. I've tried to keep myself out of this space for the last five years and thought I'd bring everyone up to date. Since 1974 I have earned a law degree, been admitted to practice before several bars, and served as White House Correspondent for Washington Wire, a national news service. For the last two years I've been investigating President Carter's finances. The first fruits of this effort are in *The Nation* of May 19, 1979, for those who are interested.

It is with sadness that I report the death on January 17, 1979, of our classmate **Alvin Paul Fort** of Brighton, Massachusetts. I remember Alvin as one of the more cheerful athletic types in the class and wish to extend condolences to his wife and family. — **Peter Peckarsky**, 950 25th St., N.W., Washington, DC 20037

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Raymond Kurzweil's excellence in computer science was recognized by the Association of Computing Machinery when he was awarded the Hopper Award as an outstanding young computer professional. . . . **Arthur Davidson** and Janis reported the birth of their first child, Heather. Also, he is spending a year working on basic applications of Josephson devices in the Physical Sciences Department of IBM. . . . A similar announcement comes from the **Dean Roller** family — a son, Shawn, and after finishing his cardiology fellowship at Yale, Dean will practice in Coral Gables.

Leland Shaeffer's plans are uncertain after finishing his M.B.A. at Stanford. . . . After passing his neurology boards, **Ronald Polinsky** is doing research in neuro-pharmacology at N.I.H., Bethesda, MD. . . . **Stephen Smith** is a professor at the University of Illinois, Chicago Circle. . . . Process Development at Owens-Corning Fiberglas is one of the activities of **James Duggan**, along with year-round tennis, his old house, two sons and spouse. . . . **Joseph DiLiberto** has been named Manager of Advanced Engineering Technology for Monroe. Prior to that he was associated with Vydec, Inc., and Dataram Corp.

Rich Rosen, although still playing basketball on a weekly basis, has had to make room on his schedule for Assistant to the F.T.C. Chairman and staff attorney in anti-trust litigation. Outdoor skiing, hunting, and fishing, etc. with **Sydney Jackson** — but only when he is not working at Los Alamos on his CO₂ Laser Fusion Program. . . . **Barbara Soliner-Webb** is finishing a post-doctoral at Carnegie Institute and will join the faculty at Johns Hopkins Medical School. Donna (Moon) ('71) and **Dan Galehouse** have both finished Ph.D.'s at Berkeley and now live in Walpole. Dan is at Polaroid and Donna is on leave from Tufts Medical School after the birth of a second son.

Larry Kelly sent a wedding announcement indicating a June marriage to Linda Garner. We are awaiting the birth of our second child in November and are surviving the interior finishing of our new house. — **Robert Vegeler**, Secretary, Kennerk, Dumas, Burke and Backs, 2120 Ft. Wayne National Bank Bldg., Ft. Wayne, IN 47802

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It is my sad duty to report the death of **Kevin George**. Kevin was killed in a hang gliding accident in Makapou, Hawaii, on April 26, 1979. He was living there while working on a computer project for the U.S. Navy. His sister, Samantha George, (Lionel A-22, Harvard) asked that memorials be sent to Greenspace Foundation, 240 Fort Mason, San Francisco, Calif. 94123.

I had dinner with **Chris Brewster** who is back in Houston as Assistant Treasurer with Geosource, Inc., after returning from a two-year assignment with the company in London. Chris is looking good and is driving a nice new BMW. . . . **Steven Morrow** accepted employment with Boeing in Renton, Wash., and closed up his software consulting business in Burlington, Mass. He has purchased a home in Kirkland. **Ellen Koerber** is practicing internal medicine in Dallas, Texas and ran into Maureen Alexander '74, who is a resident at one of her hospitals. . . . **Robert Chidlaw**, compelled to write for the first time, says: "I have been working for the past five years at EIKONIX in Burlington, Mass. and am now a senior scientist, doing work in electro-optics and image processing. Bought a house last year from a classmate, **Howard Bruck**. What a coincidence! Keep myself amused with music and electronics, have just completed building a music system. . . . **Michael Stevens Rees** is starting private practice in internal medicine in Raleigh, N.C.

Gary Pullar (836 Judson Ave., Evanston, Ill. 60202) is the manager of budgeting and cost accounting for Central National Bank in Chicago. . . . **Benjamin P. L. Feng** is working as manager of investment banking department of the Taipei branch of Citicorp, N.A. . . . **Marty Jack** is now enjoying life in southern New Hampshire and is still with Digital Equipment, working on compilers for the VAX 11/780. . . . **Marc Kahgan** received an M.D. from Tulane Medical School in 1976, interned at Charity Hospital in New Orleans and is now in his second year of psychiatry residency at Tulane. He received an award from medical students in May of 1979 and also obtained his private pilots' license.

I hope that by the time this reaches press the gas crisis has eased. It is unusual to see so many service stations closed in a small town like ours. The economic effect is going to be devastating. Please write. — **R. Hal Moorman**, Secretary, P.O. Box 1808, Brenham, TX 77833

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Steven Shanitzis is working in Washington as a senior consultant at International Energy Associates, Ltd. He spends a lot of time cruising on Chesapeake Bay and was married to Paula Gail Berman in June. **Alan Henricks**, also recently married, bought a house and expects to become a father in September. His comment on his job is "more games, more fun just like M.I.T.," and it may well be the truth, since he is director of finance at Atari. . . . Another father, **Lewis Jester**, writes that he and Suzanne have a daughter, Larissa Tiffany, on July 10, 1978. He is still with Standard Oil of California, working in the Supply and Distribution Department. After an assignment in the Bahamas, he's back in San Francisco, and when he wrote his chief preoccupation was trying to cope with the Iranian disruption.

June brought degrees to a number of us. **Jerry Greer** received his S.M. from Sloan and returned to Chas. T. Main, Inc., in Boston as a project manager. **Marc Fuller** earned his Ph.D. in electrical engineering from Michigan and immediately began work at Bell Labs in Andover, Mass. **Robert Reiter, Jr.** expected his Ph.D. from Maryland in computer science. His immediate plans were a lengthy vacation after "working like a beaver on my dissertation while regularly fighting off distractions in the form of lucrative employment offers."

Lynn Roylance is marrying Payne Freret this summer. After graduation she spent the summer in Europe with Suzanne Schulz, '71, then went to Stanford to do graduate work at the Integrated

Circuits Lab., leading in 1973 to her M.S.E.E. and "a Ph.D. (finally!) in January 1978." She has been working for Hewlett-Packard for the past two years. **Vincent Darago** is a founding board member and vice president of Urban Scientific and Educational Research, Inc., a nonprofit media and consulting firm which sponsored the first P.B.S. satellite interconnection for a live broadcast of the May 6, 1979 nuclear power demonstration in Washington, D.C. . . . **Bob Goodof** left Michigan to spend the summer backpacking in the White Mountains and is now living an hour from Boston and glad to be back. He is working for Continental Plastic Beverage Bottles as an advisory scientist and product evaluation manager. . . . **Michael Harvey** has been nominated to the executive committee of the Boston section of the I.E.E.E. He has left his consulting firm in New Hampshire and is now a member of the Electronic Systems Section of Arthur D. Little, Inc.

And now a few words from the most prolific writers in the class, the doctors. **Mark Hlatky** is moving to San Francisco for two years as a Robert Wood Johnson Clinical Scholar after completing his residency in internal medicine at Arizona. **Paul Lentricchia** is chief resident in general surgery at the Rhode Island Hospital. **Lawrence Klein** is back at Johns Hopkins for a two year fellowship in internal medicine provided by the Kaiser Family Foundation to prepare for a career in "academic general medicine." **Alfredo Sadun** has returned to Boston to do a residency in neuro-ophthalmology at Mass. General, but he remains involved in a number of research projects. He and his wife, Debra, would love to hear from some of his old classmates. **Alan Cooper** is finishing his final year of psychiatric residency in Charlottesville, Va., after earning his M.D. at the Medical College of Virginia and doing two years of his residency in Richmond. He likes Charlottesville so much that he intends to stay there with a fellowship in pain management at Virginia. He reports that **Bruce Tanenbaum** is also completing his psychiatry residency there. **Norman Kohn** just married Lisa Salkovitz (Harvard '72), an attorney. He is a neurology resident at the University of Chicago Hospital. They had a "magnificent" honeymoon in Italy and plan to live in Hyde Park, Ill.

Kathy Kram decided to take a part-time teaching position at Yale next year while she finishes her Ph.D. She recently returned from an extended working holiday in Florida. . . . A couple of classmates have recently dropped in to visit while in New York. **David Krackhardt** was East for **Mike Callham's** wedding in Boston. He is finishing his Ph.D. at U.C.-Irvine and loves both California and his doctoral program. **John Gunther** was back down from Alaska, which he continues to enjoy immensely. John was full of news about our classmates, noting that: **Joe Kashi** is a lawyer for the Kenai Peninsula Borough in Soldotna, Alaska; **Terrill Chang** is married and living in the Seattle area; **Ted Trueblood** is working as an engineer in Anchorage, but John never runs into him. When John was in Boston last October **Dan Bloom** got off "his virtual deathbed" to drive in from Arlington to Cambridge to help John bail his car out of a gas station in the middle of the night. Dan is working for the Federal Reserve in Boston. John also saw three classmates in their Institute offices: **Bonnie Kellermann** at the F.A.C. and **Joe Edwards** and **Janie Matriciano** at the Educational Council. Finally John asked "Where the hell is **Mark Wodarczyk**?"

That's it for notes from classmates this month. My latest big litigation settled in the middle of a business trip to Dallas, which is fine with me since it freed me up to take off for the West next week to do some backpacking and river rafting. Hope you all have a good summer and send in your news. — **Wendy Erb**, 531 Main St. — Apt. 714, Roosevelt Island, NY 10044

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Greetings from wherever. **Dean Kross** asks if **Bill Elkus** "is really doing TM and consults for BCG's Menlo Park office?" **Greg Daley** is working for

Philips Petroleum (grrr!) in Bartlesville, Okla., as a senior engineer in geothermal, coal, and uranium. He's "discovered flying, but not forgotten sailing." **Adela Hadiwono Hergenreter** moved to Hawaii and loves it there. She is a programmer/analyst for a data processing company in downtown Honolulu.

Buddy Stern is continuing his residency in internal med at George Washington University Medical Center. **John Dulcey** graduated Jefferson Medical College in June 1977, married Martina Phelan (Simmons '79) and is now a second-year resident in family medicine at Sacred Heart Hospital in Allentown, Penn. **Chris Tavares** and his wife Leanne have settled in their own Springfield, Va., house. The Tavareses are expecting deduction #1 in the fall. **John Breen** and Wendy produced theirs in March, ne Chris. John is employed in Kodak's instant camera design department as a senior design engineer. **David** and **Elizabeth Lund Zahniser** ('75) are in the Netherlands where she is working as a city planner for the city of Nymegen. Still they have no car, being typical Dutch they bicycle everywhere. They expect to return when David's medical work finishes in about two years.

Tim Backstrom is an attorney in the Pesticide Div. of E.P.A. General Counsel. He is working on suspension of 2,4,5-T, linked to increased rates of miscarriage. **Eric Stern** and Janet produced Joanna, #1 in March. He is currently a resident in internal medicine at Columbia Presbyterian, and is to start a cardio fellowship at N.Y.C.'s Mt. Sinai soon. **Gary Holland** lives in D.C. supplying computers to Uncle Sam. **Glenn Ishikawa** will be starting his last residency year at University of Southern California's Los Angeles Medical Center in emergency medicine.

Joseph Hadzima will graduate Harvard Law in June to work chasing papers for Ropes and Gray in Boston. And **Mike Scott** will travel Europe for Hewlett-Packard's Data Systems Division. Yours truly is in limbo before taking that lovely house you all read about. Bless my company! — **Robert M. O. Sutton**, Secretary, 2005 Cedarwood, Carrollton, TX 75006

74

Five years can be a very long time. I can remember when the cry of "Four More Years" would send shudders up and down my spine. But that (as all those of you who majored in the humanities well know) is THE PAST. This is the present and I would like to announce the rise to power of yet another regime. Elections were held in June at the Class Meeting (the what?) during Class Reunion (the WHAT?) at the Alumni Pool (the Where?). New class officers were ushered into their places in history (WHO?).

For those of you that made it this far into the class notes without fading, please send a self-addressed stamped envelope (S.A.S.E) to the address posted later in this column. You will receive absolutely free with no obligation your name in print with a complimentary story having little or no relation to the truth. However, it may be stimulating and thought provoking which is probably more than most of us are used to in this society.

In short, let us as a class collectively get our stuff together and make this column work for us as a forum, an information center, a gossip column, a filler to make this rag look fatter, or as anything you might want or need (subject to the usual censorship; if you would like the unexpurgated text of this yellow journalism, the usual S.A.S.E. to the address below will suffice.)

Let's talk about the Reunion. It was fun. There were more people than were expected. I think the group that prepared and coordinated the Reunion deserves a big THANK YOU for some good hard work. Five years from now, if those of you who didn't show up want to show off or find out what is going on then this is the event.

Now for the little tidbits you've all been waiting for: the news (in no particular order of importance).

Ludwig Chang, who is with N.B.C. is considering getting his own show to up the ratings.

dreamed I saw **John Hill** last month, alive as you or me. Anything will grow and prosper in California. . . . **John Powley** is going to weather the coming recession in seclusion at a local Cambridge learning resort. My lips are sealed until the next issue. I have received threats against my typewriter. . . . **Jon Tierney** (5'6", 102 lbs. in the blue hockey shorts) is extremely close to being a member of the Society of Actuaries. We will miss him.

Dennis Dickstein has infiltrated the federal government/H.E.W. as a sleeper agent. It's our tax dollars, Dennis. . . . **Abbie Gregg** is heading for Arizona in the near future to clean up the state. Good luck Ab and don't buy any ocean front property. . . . **E. Martin Davidoff** (or Marty as some of us call him) is collecting subway tokens in New York City and is thinking of interesting ways to use our class monies. He will accept suggestions. The number "7" and various horses are out of the question. . . . **Henry Magno** has become a notable in the antique Mercedes circles around New England. If you have a pre-war 540SSK, he would be extremely interested.

Hillary Morgenstern told me she was getting into teeth. I think it's like dentistry.

I would like to hear from the following people or from anyone else for that matter: **Jeffrey Mayne**, **Thanet Norabhoompipat**, **Jeffrey Ng**, **Stephen Fantone**, **Joan Bender**, and **Ted Shifrin**. I intend to single out people in every column for special treatment. This can be avoided by sending me one (1) share of I.B.M. stock.

If any of you know of anyone who is not getting *Technology Review* and wants to, there are two ways to cure this condition. If you have contributed \$\$ to the M.I.T. Alumni Fund, you should be getting T.R. (if they have the correct mailing address). The other way is to buy, beg, borrow, or steal it. Few things in life are so cut and dried.

Speaking of "lists," I have in my possession the Alumni Association mailing list for the class. I would be very happy to receive updates of your addresses.

Election News: The following important people were elected to high-paying positions as class officers: President: **Sandra Yulke**; Treasurer: **E. Martin Davidoff**; Secretaries: **Lionel Goulet** and **James Gokhale**. The only real benefits of filling one of these positions is that you get to work real hard for five years and put it on your resume if you like. It shows character and definite masochistic tendencies.

O.K. Now it's your turn. Get those cards and letters into me two months ahead of the issue you want your news in. I also need cat food coupons. Remember, this is your column. So get your hand out of your pocket and write. Your congressman is probably a good start. No chain letters, please! Some advice: "Don't follow leaders, watch your parking meters. . . ." Chou, Chou, Chou. — **Jim Gokhale**, 6 Burton St., Arlington, MA 02174; **Lionel Goulet**, 34 Tremlett St., Dorchester, MA 02124

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Lots of news, mostly via the Alumni Fund: **Allen Hart** is working in Falls Church, Virginia for Computer Sciences Corporation developing software and control systems. He and his wife had a baby girl, Erin Lynn, on Sept. 3, 1978. They bought a townhouse in Reston, Va. and moved there in July. . . . **Joe Wrinn** is still working at Teradyne in Boston. He's also keeping busy with MBA courses at Boston University at night. He says his son Patrick is into the "terrible two's," keeping his wife and him constantly on the run. . . . Other MBA people are **David Jessich** and **Jim Simon**. David received his degree in finance in March, 1979 from the University of Chicago. He's now working for Esso Eastern in Houston with an initial assignment as a contact engineer in Exxon's Baton Rouge refinery. Jim just finished up his first year in the MBA program, also at U. of Chicago. He's been admitted to the Ph.D. program but hasn't yet figured out if he really wants to spend more years in school. . . . Two classmates who are still enduring school are **Bruce**

Miller, a grad student in physics at Illinois, and **Michael Stiefel** here at M.I.T. Michael is in an interdepartmental Ph.D. program encompassing nuclear engineering, political science and the history of technology. His thesis topic is the study of the history and politics of the nuclear breeder reactor program. He'll have an article on energy policy in a forthcoming *Tech Review*, perhaps even this issue. Check it out.

Paul Puffe graduated from Concordia Seminary in St. Louis this May and has been ordained and installed as Pastor at St. Thomas Lutheran Church, a country church in Ann Arbor, Mich. He did some graduate work in Old Testament in St. Louis, and will continue to study part-time at the U. of Michigan in Ann Arbor. He included a note to his old buddies: "Eli dropped our table-stove on the floor but with a little glue, etc., it keeps on working."

Medical school students are finishing up! **Lena Sun** is interning at Long Island Jewish Hospital, having started in July, 1979. Lena graduated from Mt. Sinai School of Medicine in May, 1979. **Thomas F. Fleischhauer** graduated from the University of Virginia Medical School, Charlottesville, Va. on May 20th. Tom is now at Lackland Air Force Base as a resident in internal medicine at Wilford Hall Hospital, San Antonio, Tex. and will be there for 4 years. **David Yauch** graduated from Baylor College of Medicine and in June began his medicine residency in Los Angeles. **Edward Weinberger** finished Harvard Medical School and married S. Katherine Bloomer, his classmate, on May 5, 1979. They started their internships in Seattle in June. The University of Vermont College of Medicine awarded M.D. degrees to **Linda Forrester Chambers** and **Dean Calcagni** on May 18, 1979. Contratulations to you all.

Congratulations are in order for class Vice President **Ilene Gordon**, who married Abram Bluestein in Boston on April 21, 1979. They had both been in England working for the Boston Consulting Group and are now living in Chicago still with BCG.

As always, it was good to see **Betty Spiess** and **Susie Fuhrman** who were in town for the June commencement to watch Larry Ozarow (Ph.D., EE) and sister Mimi (S.B., GY), respectively, get their degrees. Susie informed me that **Kay Anderson** is living in Boston's North End and is working for the office of Mayor Kevin White.

Chuck Digate was recently promoted to Controller of Time Products Division of Texas Instruments in Lubbock, Tex. — "a real opportunity to turn a business around." . . . **Pat Callahan** is living in and loving San Francisco, working for Crocker Bank as a manager in the Operations Division, "pretty far from mechanical engineering." . . . **Holli Jones** is working for Polaroid Corp., Sesame Division in Norwood, Mass. as a technical supervisor in the analytical lab. . . . **David Wargo**, whom I occasionally run into at duPont Gymnasium, is working for the State Street Research and Management Co., in Boston, in the area of investments, after having gotten master's degrees in nuclear engineering and in management from Sloan School, at M.I.T. . . . **F. Patrick Schultz** recently joined Comperwood Interests, a real estate development firm in New York City and Houston, Tex.

Thomas B. Higgins writes: "Worked in Houston, Tex. from early 1976 til the summer of 1978. There I joined the Church of Jesus Christ of Latter-Day Saints, better known as Mormons. After a two-month intensive language course, I began a full-time mission for the Church in the province of Quebec, Canada, chiefly among French-speaking people. I love it. Former Catholics like myself make the best Mormons. In the summer of 1980, I will probably return to my old firm, Gentry, Haynes & Whaley, Inc. in Houston to work in structural design of commercial buildings."

Moray P. Dewhurst is "still alive and working my way along the negative time axis." . . . **Marta Greenberg** is now living in southern California, enjoying the sunshine and rain but missing the snow. **Peter Blanshan** says married life is treating him fine. . . . **Avi Swartzon** is Senior Engineer at Reliability Projects, Eastern Airlines. He's president of the Alumni Club of Miami. . . . **Larry Shiller**

has been in the Miami-Ft. Lauderdale area since August, 1978. Before that he worked in Toledo, Ohio in a number of positions, including violinist in the Toledo Symphony, Industrial Engineer at Owens-Illinois, and Actuarial Analyst/Research Supervisor at Blue Cross of Northwest Ohio. More recently, he has started his own company, Skill Services, Inc., and is specializing in computer programming for microprocessors. As an avocation, he started a recording group playing rock and disco, and recently released a single in the South Florida area. Larry is roommates with **Len Enriquez** who is working for Eastern Airlines and apparently doing quite well climbing the corporate ladder there. They frequently see **Glenn Ferri**, also living in the Miami area.

I am sad to report the death of classmate **Michael Charette** of Granby, Mass. in April of this year. After M.I.T. Michael had attended the University of Washington in Seattle. He was doing post-graduate work at the California Institute of Technology at the time of his death. — **Jennifer Gordon**, 22 Centre St., No. 9, Cambridge, MA 02139

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A plethora of news, some slightly ancient, some relatively fresh.

From a telethon earlier this year, I learned that **John Wacker** is at the University of Arizona, Tucson, in the Department of Planetary Sciences. He is doing geochemical analysis, using microprobe and mass spec techniques for the study of meteorites in understanding the formation of the solar system. He definitely likes Boston better. Can't say I blame him. . . . **Bill Vagt** is in law school at Lewis and Clark in Washington state, after spending several years with Shell Oil. . . . Back at the University of Arizona, we find two more '76ers — **Mike Feierberg** and **Dave McDonough**. Dave works in the infrared spectroscopy lab in the Department of Planetary Sciences. . . . **Dennis Waldman** is a systems design engineer for Northrup. . . . **John Kaplan** is engaged to a schoolteacher, whose name was not provided, and will be married July 28. He is still to be found working at Polaroid. . . . **Tony Lake** and **Keith Amundsen** are still with Digital Equipment. **Joe D'Amore** is taking night courses at Rutgers University to get an M.S. in environmental engineering. . . . And **Norman Lambert** is with Martin-Marietta in Orlahdo, Fla., doing computer-aided design. . . . **Gwendalyn Champion** is a grad student at Johns Hopkins. . . . **Dave Walker** is working for Control Data Corp. in Waltham.

From the mails, we learn that **Steve McConnell** received his M.S.E.E. (computer engineering) from Carnegie-Mellon in May 1978. He is still there in grad school pursuing a Ph.D., and is spending this summer working as a volunteer engineer with Wycliffe Bible Translators helping in computer system development. . . . **Peter Galitzine** left Hydrotech Corp. in New York in January, 1979, to start with Aultech, Inc. in Port Chester, N.Y. They specialize in ground support equipment and dedicated test stands. Peter entered at the project engineer level and "find[s] it a pleasing challenge. Hunting has taken over from road racing this year, but a 'terror bike' is in the works for next."

Ken Virgile has been working as a programmer at Datatrol in Hudson, Mass., since graduation. He married Helen Mayer in August, 1978, and just bought a house in Lexington. . . . **Tom Gaskin** writes that he is "now in Newport News, Va., still an air force officer, but working for the army as a traffic engineer. I have bought a home with the hopes of staying in one place for more than six months for a change! I hope to be doing Department of Defense railroad studies soon."

Dan Christman reports that he "moved to Cumberland, Md., in August, 1978, to take a position as senior engineer in hazards analysis. Am active in the local performing arts: Cumberland Choral Society, Arion Band, Frostburg Community Theatre, Frostburg College Orchestra, Potomac Concert Band, acted in 'South Pacific,' played in 'Oklahoma.'" . . . **Chris Garrod** is "living

happily in La Jolla and going to school — been busy at the Scripps Institution of Oceanography and becoming a satellite oceanographer. . . . **Gene Chang** visited on business. **Dick Mulligan** also visited here and I enjoyed a delicious Easter dinner with his family." . . . From **Jeannie Chermak**: "Life is interesting. I'd just begun working for a new computer firm in Nashua, N.H., when, after five months of employment, it (practically) 'folded.' That's a work experience I don't care to repeat! But it brought me near Boston (from California), and the experience was enlightening. Happily, many companies want 'computer people' — there was plenty of interest in M.I.T. graduates. I am now working for Softech in Waltham and may move into the area from New Hampshire."

And quoting **Fred Walter**: "Work, work, work, work, work — looking up and seeing spots. Still piddling around on my way to a degree in astronomy." . . . **Nick Nussbaum** is "now working as a typography programmer at Qualex in Kendall Square. This summer I am producing 'The Mikado' for the M.I.T. Community Players."

. . . **Phil Lorang**, working for the U.S. E.P.A. in Ann Arbor, reports his dismay at indications of growing conservatism on the M.I.T. campus. . . . **Deborah Stein** writes that she is "currently working for G.E. Silicones and living in Saratoga Springs, N.Y. We are collecting quite a crew of M.I.T.'ers there. I will be leaving this summer, first to get married and then to attend business school full time at Harvard."

I also got a postcard from **Erland Van Lidthe de Jude**. "I'm stuck at a Lutheran college (Concordia Teachers College) in a dry town here. . . . I'll have a shot at the World Games wrestling team. . . . Next I'm leaving for a dry county in Tennessee (Middle Tennessee State University)." Erland left Citibank to train full time for a spot on the Olympic wrestling team. Our sympathies for his lack of alcoholic refreshment.

I am afraid the material we gathered (**Tom Martin**, **Dan Dershowitz**, **Mark Crane**, and **Tony Lake**) at the most recent telethon will have to wait. I apologize, but the very rapid price changes in the coffee market are really keeping me hopping. (not to mention, occasionally glued to two telephones and the ceiling simultaneously). — **Arthur J. Carp**, Secretary, Endymion Commodities, Inc., 131 State St., Suite 616, Boston, MA 02109

78

Good day sports fans. I write from old Cambridge, where I'm spending the rapidly-ending summer. I have a pile of news arranged in no discernable order, and I intend to proceed in like manner.

A note to all those classmates who just received their bachelor's this year: the Alumni Association automatically lists you as a member of the class with which you graduate. This may not seem to have any consequences for most of you; however, it does have some for me. Technically, I'm only supposed to write about people in the class of '78 — so I won't be able to write about our recently graduating classmates and your friends may not be able to find the news about you. What do you do about this "catastrophe"? You simply write a note to the M.I.T. Alumni Records office and tell them your story and they will be glad to change you to the class of '78.

For those of you who haven't yet heard, this year's graduation was held in a light rain in the Great Court. Even including the brief drizzle, it was a beautiful ceremony; in fact, the bushes around the court decided to bloom in honor of the day. The rain had its positive effects too. Feeling for the plight of those sitting in the open court, Dr. Wiesner only read every other page — more or less — of his speech. People said that it was one of his best speeches in recent memory.

Bernie Kempinski, **Winslow Cuthbert** and **Kurt Cogswell** took a short trip recently and Bernie thought he should report about it. Their trip was to beautiful sunny South Dakota. (For a change it wasn't to Southern California.) What Bernie wants you to know, however, wasn't so much about where they went, it was more about a short stop along the way . . . at two in the morning. They

were driving along Interstate 80, one of the major thoroughfares connecting the two coasts. In Pennsylvania, though, the road is known for its potholes. At 2:00 a.m. Bernie, Winslow and Kurt took a brief visit into one of these potholes and came out with one dead tire. So please be warned.

This month's first guest star is **Dennis McMullen** from Cincinnati. Dennis had spent most of his recent summers working on the grounds crew for the Cincinnati Reds, as he did last summer. While working in that capacity he noticed that the position of Assistant to the Director of Stadium Operations was available, so he took that position for last season. Then for the winter the Reds shipped him down to Tampa where he was Director of Stadium Operations for spring training. This summer he's back on the grounds crew, getting ready to go back to school — he'll be going to the University of West Florida to study marine biology.

Mark Bye is at M.I.T., working on his masters in Chem.E. He was also working for the Dean for Student Affairs Office as an intern dean. And he and Marianne have announced their engagement, but I haven't heard of a planned wedding date. . . . **Regina Murphy**, a secret source reports, got married to Mark Edsel and is working for Chevron in San Francisco as a Chemical Engineer. . . . **John Anderson** is a Second Lieutenant in the Army, stationed in Germany. His wife, the former Glenda Coffee — a hometown sweetheart — moved to Germany just recently.

More marriages: **Leslie Rosenthal** is marrying Scott Schlecter, '75, and they'll be staying in the Boston area; **Dorothy Klepac** is marrying Ken Keverian, '79, and they're moving to New Jersey; **Kathy Lyon** married her former 2.761 T.A., Michael O'Callaghan — Kathy's working at an accoustical consulting firm on a project concerning pump-created ship noise. . . . An anonymous tipster reports that **Skip Page** (working at Chevron Chemical in Richmond, Calif.) and **Debbie Abbott** (working for an architecture firm in the S.F. Bay area) are getting married this summer. . . . My tipster also reports that **Brian Maiorella**, of I.A.P. iceblock fame, is "working on a master's in Chem.E. at Cal trying to make vodka faster than anybody else!" Brian, Skip, Debbie, if you ever figure out who the source is please let me know.

Robert J. Ledoux reports that he is getting married on August 25, but he doesn't say to whom. . . . **Scott Tobias** married Robin Graves, '79, this January, and they honeymooned at Disney World in Orlando, Fla. They're living in Cambridge, near Inman Square, and Scott's working for Teradyne, Inc., near South Station. . . . **Liz Kendall** and Tim Casey got married last May. They're living out in Seattle, where they work for Boeing and own a big boat.

Alan Marcum (technically in the class of '79 because he just graduated this June, getting two bachelor's and a master's) wrote to tell of his travels. He spent a semester in Co-op for Hewlett-Packard in Palo Alto, Calif., working on the APL computer language. This work resulted in AI publishing several papers and he hopes to be able to present a paper to the APL '80 conference to be held next year in Holland. AI will be joining H.P. Labs permanently in the fall to do more computer systems research. This summer he plans to travel in Europe. At the time of his letter, AI was in Phoenix to participate in the tryouts for the Pan American Games rifle team. AI started shooting competitively as a freshman and I believe one year he won an award for the most improved member of the highly successful M.I.T. Rifle Team. AI writes that four other M.I.T. shooters were also at the Pan-Am tryouts.

As for your tired secretary (at 1:30 a.m. with the deadline this morning) I'm working at the Boston branch of the U.S. Attorney's Office in the Criminal Division. F.B.I. agents don't really look like Ephrem Zimbalist, Jr. And today I met my first convict and defendant. If you're in town for the summer, live here or are just passing through, give me a call or drop me a line (I'm always hospitable, but never home). — **David S. Browne**, 17 Elm St. No. 4, Cambridge, MA 02139, (617) 661-0668

Civil Engineering

Four promotions from assistant to associate professor, effective July 1:

□ **Rafael L. Bras**, '72 (surface water hydrology). Dr. Bras worked as a natural resources specialist with the Puerto Rico Department of Natural Resources in 1972-73, then returned for graduate degrees (S.M. '74, Sc.D. '75) at M.I.T. After a year at the University of Puerto Rico, he joined the M.I.T. faculty in 1976 and since then has worked on rainfall analysis and runoff management.

□ **Steven R. Lerman**, '72 (transportation systems). As Gilbert Winslow Career Development Assistant Professor in 1977-78, Professor Lerman made significant contributions to travel demand modeling. He joined the faculty upon completion of graduate work at M.I.T. (S.M. '73, Ph.D. '75).

□ **Raymond E. Levitt** (construction management). Professor Levitt came to M.I.T. in 1975 with a brand new Ph.D. from Stanford; his earlier work had been at the University of Witwatersrand (South Africa). Since then he's worked on various construction problems, especially safety.

□ **John L. Wilson**, Ph.D. '74 (groundwater hydrology). At M.I.T. ever since finishing his B.C.E. at Georgia Tech in 1968, Professor Wilson is a specialist in the fluid mechanics of groundwater movement and its management (including mathematical modeling of groundwater systems).

Glenn A. Kriger, S.M. '76, writes, "I am currently the lead foundation engineer for the Woodside-North Rankine Offshore Platform A which is to be installed in 410 feet of water off the coast of western Australia in 1982-83." ... **Edward C. West**, S.M. '56, gives an account of his activities since retiring from the army in 1972: "Became executive vice president of Green International, and president in 1975. I left Green in 1976 to form Edward C. West Associates, management consultants." ... **Charles S. Thomas**, S.M. '72, is assigned to the U.S. Army Corps of Engineers, Middle East Division in Riyadh, Saudi Arabia. ... **James K. Mitchell**, Sc.C. '56, was appointed chairman of the Department of Civil Engineering at the University of California at Berkeley on July 1.

Ernest Lindner, S.M. '75, is a doctoral candidate at the University of Minnesota majoring in rock mechanics. ... **Kenneth Maser**, Ph.D. '71, writes, "Appointed manager, Materials and Structures Division of Foster-Miller Associates in Waltham, Mass., effective February, 1979. Recently married, on April 8, 1979, to Susan Lutwak. Susan is a project planner for Cambridge Collaborative." ... From **Saturnino Suarez**, S.M. '76: "For the last year-and-a-half I've been involved in the construction of the 48-inch Mexican gasoline from Cactus in the southeast of Mexico to the U.S. border in Reynosa. I have been the administrative and planning superintendent in I.C.A., the company building the northern portion of the line." ... **Robert S. Braden**, S.M. '54, president and chief operating officer of the 600-

member, Houston-based consulting engineering firm of Turner Collie and Braden, has been awarded as Distinguished Graduate of the College of Engineering by the University of Texas at Austin.

Mechanical Engineering

Stephen H. Crandall, Ph.D. '46, Ford Professor of Engineering, received the Trent-Crede Medal of the Acoustical Society of America during the A.S.A.'s 50th anniversary national meeting at M.I.T. in June; he was cited "for outstanding contributions to the science of mechanical vibration and shock, ... especially those aspects of random vibration associated with components and structural failure."

Three members of the department have been promoted to associate professors:

□ **Michael J. Cleary**, who's been C. R. Soderberg Assistant Professor in Power Engineering. Professor Cleary's field is continuum mechanics, with current interests in the behavior of geological and/or porous materials. His undergraduate work was at the National University of Ireland (B.E. 1972), and he holds graduate degrees in mechanics and structures from Brown (M.S. 1974, Ph.D. 1975).

□ **David C. Gossard**, Ph.D. '75, a specialist in computer-aided design and manufacture. Professor Gossard came to M.I.T. in 1970 from Purdue, where he received bachelor's (1968) and master's (1970) degrees in mechanical engineering, and he joined the faculty in 1975.

□ **Derek Rowell**, director of M.I.T.'s Sensory Aids Evaluation and Development Center since 1975 and of our Joint Computer Facility since 1978. Professor Rowell came to M.I.T. in 1973 to work in rehabilitation engineering, and he joined the faculty in 1976; he holds engineering (B.E. 1966) and electrical engineering (Ph.D. 1970) degrees from the University of Canterbury, New Zealand.

Frederick Kuo, Jr., S.M. '70, is principal engineer, nuclear standard at Ebasco Services in New York City. ... **Frank J. Heymann**, S.M. '53, writes, "Still employed by Westinghouse Steam Turbine Division. For the last three years I have been chairman of ASTM's Committee on Terminology; in September I'll present a paper at the fifth International Conference on Erosion at Cambridge University." ... **Anthony C. Lunn**, Sc.D. '72, has moved to a new job as project leader, Chemical Research Division at American Cyanamid Co. in New Jersey. ... News from **Serope Kalpakjian**, S.M. '53: "Appointed associate editor of the *Journal of Applied Metalworking*, a new publication of the American Society for Metals. Also elected a corresponding member of the International Institute for Production Engineering Research."

Bill Verplank, S.M. '67, has moved to Los Angeles where he works for Xerox and lives near the beach. ... **James R. Bledsoe**, M.E. '62, recently joined Dearborn Tool and Machine Corp. as

design/applications engineer working with the development of high-production CNC turning/boring industrial machines. ... **David W. Mercaldi**, M.E. '76, has joined General Electric Research and Development Center. ... **Larry J. Forney**, M.E. '69, recently received a joint appointment as associate professor in the Schools of Chemical Engineering and Civil Engineering at Georgia Institute of Technology.

Materials Science and Engineering

Honors to two members of the faculty at the annual meeting of the American Ceramic Society in Cincinnati late this spring: Professor **Robert L. Coble**, Sc.D. '55, was Sosman Memorial Lecturer (the Society's highest recognition for basic research in the properties of ceramics); and Professor **H. Kent Bowen**, Ph.D. '71, who was inducted as a fellow of the society at the meeting, received the Schwartzwalder Award for professional achievement in ceramic engineering.

Three promotions from assistant to associate professor became effective in the department on July 1:

□ **Joel P. Clark**, Sc.D. '72, a principal in the development of our research and teaching programs in materials systems and policy studies. Dr. Clark came to M.I.T. from Florida State University in 1970 and after finishing his doctorate worked in research and development for Texas Instruments, Inc., from 1973 to 1975; then he returned to M.I.T. for a master's degree in the Sloan School and to join the Course III faculty.

□ **Chong Sook Palk Sung**, a native of Korea whose work is in the field of polymer science. Professor Sung came to M.I.T. in 1976 to work on biomaterials and modern polymers; her degrees are from Seoul National University and the Polytechnic Institute of Brooklyn (Ph.D. in polymer chemistry, 1972).

□ **Harry L. Tuller**, whose specialty is ceramic materials with special optical and electrical properties. Dr. Tuller's degrees are in electrical engineering and solid-state science from Columbia University; he came to M.I.T. in 1975 after a year of research experience at the Technion — Israel Institute of Technology.

Morris Cohen, Institute professor emeritus, is co-author of the paper "Microstructural Control in Microalloyed Steels," that has been selected for the Joseph R. Vilella Award by the American Society for testing and Materials. ... **Anders F. Henriksen**, Sc.D. '78, is a postdoctorate associate in the department, and he writes that he also is involved in several consulting assignments.

William A. Griffith, S.M. '50, was named president of Hecla Mining Co. last May. ... **Robert J. Tiernan**, Ph.D. '69, is research and development scientist/engineer at Sylvania Lighting Center in Danvers, Mass. ... **Tracy B. Braun**, Sc.D. '74, writes, "After four years at the Kennecott Metal Mining Division Research Center, I was transferred and promoted to technical superintendent at

Utah Copper Division Refinery of Kennecott in July last year." ... An announcement from **M. Kishen Koul**, Ph.D. '68: "After 14 productive and exciting years in the U.S.A., I am returning to India to take up a new challenge. My new assignment will be as executive vice president of Indian Metals and Ferro Alloys Ltd. in Calcutta — a privately owned diversified metals company involved in the manufacture of ferroalloys, metals, abrasives and steel tubular products."

Shri N. Singh, Sc.D. '66, reports, "My paper 'A Practical Solution to the Problem of Alumina Build-up in Nozzles During Continuous Casting of Aluminum-Containing Steels,' has been selected as the 1979 winner of the Frank B. McKune Memorial Award by the Iron and Steel Society."

... **Diran Apelian**, Sc.D. '73, has been promoted to associate professor of materials engineering at Drexel University in Philadelphia. He joined Drexel's faculty in 1976. In addition, he has been selected to receive the Dow Award for his course titled Design in Materials Engineering. ... From **Thomas C. Wilder**, Sc.D. '61, "I have left Kennecott Copper Corp. after having been employed by them for 15 years, and am presently self-employed as a consultant in chemical metallurgy with an office in Lexington, Mass."

IV

Architecture

Professor **Henry A. Millon** will leave M.I.T. at the end of the coming academic year to take up duties as head of the National Gallery of Art's new Center for Advanced Study in the Visual Arts in Washington, D.C. The appointment is already in effect, but the first group of art scholars will not be in residence at the National Gallery until a year from now. The idea of the new center is to make available in a systematic way the gallery's art collections and related research resources. Professor Millon has been a member of the M.I.T. faculty since 1960; in a sense he "interned" for his new job in 1974-75, when he was on leave to be director of the American Academy in Rome.

Starr Ockenga, an artist and photographer who has been instrumental in reorganizing the Creative Photography Laboratory following the retirement of the late Professor Minor White, has been promoted from assistant to associate professor. Her most recent work is an experiment utilizing photography as a means of therapy for the handicapped.

Jamie Partlow, M.Arch. '73, is now an associate in the architectural firm Omni Consultants in Houston, Texas. ... **Philip G. Freelon**, M.Arch. '77, writes, "Obtained architectural registration in February, 1979. I am now an associate with Nicholson Associates in Durham, N.C., and also teach intermediate and advanced courses in photography at the School of Design at North Carolina State University." ... From **Owen Martinez-Sandin**, M.C.P. '60, "Retired recently as director of planning at the Puerto Rico Industrial Development Co.; am now an associate of a real estate analyst and appraisal group." ... **Masaaki Sakuta**, '60, was nominated chairman of the Department of Marine Architecture and Engineering at Nikon University in Tokyo in April, 1978.

Earl Kessler, M.Arch. '71, describes his newest assignment: "Contracted to assist the Panama and South America Regional Housing Office in the planning and implementation of low-income shelter programs throughout the region. Specific responsibilities include self-help activities, community organization, and project design." ... **Chin Pai**, M.Arch. '68, is chairman of the Department of Architecture at Tamkang College in Taipei, Taiwan. He adds, "We are constantly looking for potential visiting lecturers, please let me know if anyone is interested." ... **William Q. Hubbard**, M.Arch. '76, was recently named an associate in the Richmond architectural firm Glave, Newman, Anderson and Associates. ... **Norman Quon**, M.Arch. '72, will assume responsibility for Prudential Insurance Co.'s real estate investments on Hawaii and also manage any new mortgages and ownerships throughout the island.

Astra Zarina, M.Arch. '55, has received a Distinguished Teaching Award from the University of Washington, where she has been part of the foreign study program in architecture for nine years. With the cooperation of a photographer she recently published a book in Italy, *I Tetti di Roma* (Rome Landscape). ... **William W. Caudill**, M.Arch. '47, chairman of Houston-based Caudill Rowlett Scott, architects, engineers, and energy planners, received an honorary doctoral degree from the Universidad Autonoma De Gaudalajara, Mexico, last February. ... We regret to report the death of **Arthur R. Klaeson**, M.Arch. '58. He formed his own firm in 1964, later joined by Ekman Associates, and was at the time of his death senior vice president and treasurer of the Warwick, R.I.-based Ekman Klason architectural firm. His work included the Seekonk Town Hall and the Robert Champlin Memorial Library in West Warwick. Besides his wife, Elizabeth, and parents, he leaves a son and a daughter.

V

Chemistry

Edward I. Solomon, who joined the faculty in 1977, is now associate professor of chemistry; he's a physical inorganic chemist with special interest in bio-inorganic chemistry, surface chemistry and catalysis, and the electron structure and spectroscopy of transition metal complexes. After studies at Rensselaer and Princeton (Ph.D. '72), Professor Solomon had post-doctoral fellowships at the University of Copenhagen (1973-74) and California Institute of Technology (1974-75); a year after coming to M.I.T. he held an Alfred P. Sloan Research Fellowship (1976-77).

Jed F. Fisher, Ph.D. '76, is leaving Harvard for an assistant professorship in chemistry at the University of Minnesota. ... **Barbara Van Tassel Enagonio**, Ph.D. '50, has been appointed chairman of the chemistry department at Montgomery College in Rockville, Md., where she has been a faculty member since 1966. ... **Michael A. Kay**, Sc.D. '70, recently joined Rockwell Hanford Operations in Richland, Wash., as a senior scientist in the environment monitoring program for long term management of low level waste. ... The chemistry department of Washington University has a new addition to its faculty in **Dabney K. White**, Ph.D. '76.

Fred Kagan, Ph.D. '49, with Upjohn Co. in Kalamazoo, Mich., now has the new title of group manager for C.N.S., cardiovascular and diabetes-arteriosclerosis research. ... **Janet Sanford Perkins**, Ph.D. '52, writes that she has been a member of the Council, American Chemical Society for 19 years. She was the northern section chairman in 1975, and arranged the Norris Award luncheon for J. D. Roberts, her M.I.T. thesis supervisor, earlier this year. ... **Jay H. Vreeland**, Ph.D. '58, has been promoted to director of process research at S. D. Warren Co., a division of Scott Paper.

Gail Hudson, Ph.D. '77, presented a paper on "Antiserum Characterization — Titer vs. Avidity" at the annual meeting of the Federation of American Societies for Experimental Biology in April. ... **Tobin J. Marks**, Ph.D. '71, professor of chemistry at Northeastern University, has been selected for the Fresenius Award of the Phi Lambda Upsilon honorary chemical society. The award is presented each year to an outstanding American chemist under 35.

VI

Electrical Engineering and Computer Science

Papers by our students won first and third places in the annual student paper contest of the Boston section of I.E.E.E. The winners: "A Versatile Message Display System," by **Brad A. Myers**, '79, **Larry Rosenstein**, '79, and **William Heil**, '79 (a report on the "big board," a message system used in the Building 7 lobby during the 1979 Indepen-

dent Activities Period); and "A System for Mechanical Inspection using Acoustic Techniques," by **Charles Freeman**, '80. The Myers-Rosenstein-Heil paper went on to win second place in I.E.E.E.'s regional competition.

Two members of the faculty have been promoted from assistant to associate professors:

□ **Harold Abelson**, Ph.D. '73, whose appointment is jointly with the Division for Study and Research in Education. He has combined theoretical work in computer science with uses of computer technology to enhance education, drawing on an educational background in mathematics.

□ **Stephen A. Ward**, '66, a specialist in real-time computer systems engineering. Professor Ward joined the faculty when he finished his doctorate at M.I.T. in 1974.

Professor **George W. Pratt, Jr.**, '49, will divide his time beginning this fall between M.I.T. and Tufts, where he has an appointment as adjunct professor of equine medicine in the new School of Veterinary Medicine.

Professor **Alan S. Willsky**, '69, associate director of the Laboratory for Information and Decision Systems, will receive the 1979 Alfred Nobel Prize of the American Society of Civil Engineers. He's honored for his paper, "Relationship Between Digital Signal Processing and Control and Estimation Theory."

Kirk D. Thompson, S.M. '66, is now chief engineer for Omnicomp and teaches at Arizona State University. ... **R. H. Eisengrein**, S.M. '49, reports that he was elected to the New Hampshire State Legislature for 1979-80; he also serves on the Science and Technology House Committee.

... **David L. Kleinman**, Ph.D. '63, has been promoted to full professor of electrical engineering at the University of Connecticut and has co-founded Alphatech, Inc., a Boston-based research and consulting firm. ... **Oleg V. Fedoroff**, S.M. '63, is assistant vice president of tactical data systems at B.D.M. Corp. in McLean, Va.

Roger R. Schell, Ph.D. '71, writes, "I have been assigned as a U.S.A.F./U.S.N. exchange officer with duty as an assistant professor of computer science at the Naval Postgraduate School in Monterey, Calif." ... **John Heightley**, S.M. '63, left Sandia last November for Immos Corp., where he is director of memory component development.

... **Daniel U. Wilde**, Ph.D. '66, reports, "Have been reelected secretary/treasurer of the Association of Information and Dissemination Centers and also renominated as a trustee of Engineering Index." ... **Ko Muroga**, S.M. '54, is back in the U.S. after working for Nippon Electric Co. in Tokyo for 24 years. His new position is with the company's American branch in Dallas, Texas, where he is responsible for marketing and manufacturing switching equipment.

Edwin Gabriel, '51, describes his latest activities: "Received design patent for 'electronic analog computer' in April. Two other patents are pending on analog computer labs, which will enable teachers to purchase their own computers for \$100 or less. These are book-sized and weigh about two pounds each. Students will be more motivated than ever to study math, the physical sciences, electronics, and automatic control systems. Have taken two Bible courses each semester for past two years." ... **Harold A. Spuhler**, S.M. '50, works as a consultant in Dallas following his retirement as program manager, engineering applications with the National Science Foundation. ... **Frank P. Zaffarano**, S.M. '47, is with Gould Instruments in Cleveland as a senior program manager.

Chuck Taubman, S.M. '66, writes that he is a product assurance manager at the Santa Clara division of Hewlett-Packard. He adds, "Would like to make contact with Gordon Hurford — my Ashdown House roommate." ... News from **Emmett H. Bradley**, S.M. '50: "My wife Linda and I have moved from Alexandria, Va., to Woodland Hills, Calif., and now reside at 22267½ Erwin St. I continue as president of Airtronics and its subsidiary, Powertec." ... **Daniel Crevier**, Ph.D. '75, explains that his research interests include the application of pattern recognition to power system security analysis, a field which he pursues as an associate professor at McGill University in Montreal.

VI-A

Cooperative Program in Electrical Engineering and Computer Science

Technology Day, June 8, found a number of VI-A alumni on campus. Enjoying a great reunion were eight members of the 50-year class ('29) (see photo at right) who invited the program's present director, **John A. Tucker**, to join them at the alumni luncheon. It was wonderful to hear the reminiscences of the old days under then-director, Professor "**Bill**" **Timble**. They were equally impressed with the current enrollment in the program (254) and the breadth of the companies now involved.

Harold H. Cake, '21 (VI-A at G.E. Co., Lynn Works) has sent us a marvelous collection of memorabilia on the first VI-A class to have completed both the undergraduate and graduate phases of the program. The June 1922 graduation exercises were to be held in a tent in Eastman Court (what is now Killian Court) in front of Building 10. Harold tells us that "a storm blew up — tent poles snapped — the canvas dropped and that ended the festivities. Professor '**Bill**' **Timble** declared a degree for everyone in VI-A, since diplomas were scattered throughout the tent!" For the first time since 1927 this year's graduation was again held outdoors in Killian Court.

Here for alumni activities, **H. DuBose Montgomery**, '71 (VI-A at Bell Labs.) made a special visit to the VI-A office to see John Tucker. DuBose is completing his final year as president of the M.I.T. Club of Northern California. He is with California Northwest Fund, Inc., Menlo Park, Calif. ... Here, too, for Technology Day was **Jay W. van Dwingelen**, '74 (VI-A at Hewlett-Packard, Palo Alto). Jay is with Tandem, Inc., in St. Louis, Mo. ... Another California visitor in June was **John F. Cooper**, '74 (VI-A at Hewlett-Packard) who was east on vacation. John is with Hewlett-Packard Co. in Palo Alto, Calif.

Two other VI-Aers were back on campus and came by the VI-A office for a visit. **Thomas H. Crystal**, '59 (VI-A at Bell Labs.) attended the 50th anniversary meeting of the Acoustical Society of America. Tom is with the Institute for Defense Analysis in Princeton, N.J. ... Dr. **Scott A. Keneman**, '66 (VI-A at R.C.A. Labs.) attended a special summer course on Surface Acoustic Waves given by Professor **Hermann A. Haus**, '54. Scott is a senior member, engineering staff of R.C.A.'s New Products Lab. in Indianapolis, Ind. ... Married on June 2 to Linda Fisher was **Geoffrey J. Bunza**, '74 (VI-A at Digital Equipment Corp.). Geoff is currently at M.I.T. completing his doctoral work.

John Tucker had lunch with **Keith A. Blanton**, '78 (VI-A at Texas Instruments). Keith received his S.B. and S.M. degrees at this year's graduation and is now employed by Texas Instruments in Dallas, Texas. ... Stopping by to discuss employment opportunities in Colorado was **T. Michael Hendricks, Jr.**, '69 (VI-A at General Radio). Mike is currently employed at M.G.H.'s Laboratory for Computer Science, Boston, Mass. — **John A. Tucker**, Director, VI-A Program, M.I.T. Room 38-473, Cambridge, MA 02139

VII

Three promotions from assistant to associate professor became effective July 1:

□ **Raymond M. Maker**, a specialist in the genetics of cells of animal origin working in the Center for Cancer Research. Professor Baker came to M.I.T. in 1974 following appointments at the Ontario Cancer Institute (1971-74), the Research Institute of the Hospital for Sick Children, Toronto (1973-74), and the Department of Medical Biophysics of the University of Toronto (1973-74). His degrees in biophysics are from Yale (B.S. 1962) and the University of California, Berkeley (Ph.D. 1969).

□ **Michael J. Bevan**, immunologist whose work focuses on cells important in the antigen-antibody reaction. Professor Baker studied at London Uni-



Back at M.I.T. 50 years after Course VI-A. Attending the Technology Day luncheon were **W. Gordon Bowie**, '29 (VI-A at Bell Labs. and N.Y. Tel.), **Newton W. Bryant**, '29 (VI-A at Bell Labs.), **Joseph Green**, '29 (VI-A at Boston Edison), **Samuel J. Levine**, '29 (VI-A at G.E. Co., Pittsfield), **John F. Joyce**, '29 (VI-A at Stone and Webster), **George J. Meyers**, '29 (VI-A at G.E. Co.), **Laurence R. Moses**, '29 (VI-A at N.Y. Tel.), and **Dexter T. Osgood**, '29 (VI-A at Bell Labs.).

versity and came to the U.S. in 1975 to work at the Salk Institute; he joined M.I.T. in 1977.

□ **Linda M. Hall**, a specialist in the structure-function relationship of nervous system components. Dr. Hall, who came here in 1973, studied at Bucknell and the University of Wisconsin (Ph.D. 1970).

VIII

Physics

Lawrence G. Rubin, '53, is chairman of the general committee for the Sixth Symposium on Temperature — its Measurement and Control in Science and Industry, to be held in Washington, D.C., March 14 to 18, 1982. Mr. Rubin is a member of the technical staff at the Francis Bitter National Magnet Laboratory; the symposium will be sponsored by the American Institute of Physics, the Instrument Society of America, and the National Bureau of Standards.

Three members of the faculty have been promoted from assistant to associate professors, effective July 1: **Philip C. Myers**, Ph.D. '72, whose specialty is radio astronomy of dense interstellar clouds; **Stephen G. Steadman**, an experimental nuclear physicist who has made significant contributions to understanding collisions of complex nuclei; and **Toyoichi Tanaka**, an experimental physicist whose interest in condensed matter has led to research on the properties of complex substances.

Simon Foner, chief scientist and head of the Research Division of the Francis Bitter National Magnet Laboratory, is now consulting editor of *Review of Scientific Instruments*; he's also vice chairman of the American Physical Society's Division of Condensed Matter Physics.

Charles N. Bressel, Ph.D. '65, is a member of the staff of the Advanced Systems Department at Charles Stark Draper Labs in Cambridge. ... A note from California, from **William A. Seidler**, Ph.D. '72: "I am a senior scientist in defense research at Jaycor in Del Mar — now have three lovely daughters." ... **Dave A. Campbell**, S.M. '75, tells us that he "received Certificate of Appreciation for patriotic civilian service from the Department of the Army for design and implementation of a real time computer system." ... We find a concerned citizen in **Peter Gottlieb**, Ph.D. '59. He writes, "I'm director of computer services for Dames and Moore in Los Angeles; ride bike to

and from work in downtown L.A. — 13 miles each way — to dramatize seriousness of the energy crisis." ... **Myer Geller**, Ph.D. '55, and family are alive and well, residing at 1622 Plum St., San Diego, Calif.

IX

Psychology

Dr. **Norman Geschwind**, neurologist-in-chief at Beth Israel Hospital who is associated with the Department of Psychology through the Harvard-M.I.T. Division of Health Sciences and Technology, has received the 1979 Allied Professor Award of the Massachusetts Psychological Association. The idea is to honor contributions to psychological theory or practice by professionals outside the field of psychology.

X

Chemical Engineering

Two assistant professors have been promoted to associate professors, effective July 1:

□ **Robert C. Armstrong**, an expert in polymer processing and the flow of liquid polymers. Dr. Armstrong was the du Pont Assistant Professor in 1974-75; he came to the faculty in 1973, having just completed his Ph.D. in chemical engineering at the University of Wisconsin after undergraduate work at Georgia Tech.

□ **Chritos Georgakis**, a specialist in the dynamics of chemical reactions and processes. Professor Georgakis succeeded Professor Armstrong as du Pont Professor (1975-76), and he was Edgerton Assistant Professor from 1977-79; his degrees are from the National Technical University of Greece, the University of Illinois, and the University of Minnesota (Ph.D. 1975).

Earlier this year **Harold M. Carter, Jr.**, S.M. '47, was elected vice president of Chevron Chemical Co. and general manager of the petrochemical division. ... **Dennis A. Tarczy**, S.M. '66, was recently appointed manager of development for Ashland Chemical. ... **Alexander Zakak**, S.M. '71, is working as a project engineer in the development of organic bottoming cycle systems at Thermo Electron in Waltham, Mass. ... We hear from the Gas Research Institute in Chicago, that **Sami Atallah**, Ch.E. '60, has been appointed

manager, systems safety research, there. He was formerly with Arthur D. Little.

Richard Freedman, Sc.D. '76, has joined the chemical engineering faculty at Tulane as assistant professor. . . . **David S. Swanson, S.M.** '53, has been promoted from vice president-manufacturing to senior vice president with responsibilities for manufacturing, engineering, and employee relations at Procter and Gamble. . . . **Sanjay Amin, ChE.** '73, has moved from Kalamazoo, Mich., to Bombay, India, where he is director of research for New India Industries, Ltd.

XI

Urban Studies and Planning

Henry D. Tomlinson, S.M. '55, reports, "I accepted the position of vice president-environmental engineering for Reynolds, Smith and Hills, in Jacksonville, Fla., in March this year. R.S.H. is one of the largest architectural-engineering firms in the Southeast with over 750 employees." . . . **John H. Austin, S.M.** '53, develops training programs for water and wastewater treatment for Maxima Corp. as a vice president, since 1978. . . . **William A. Cawley, S.M.** '55, has been transferred from the headquarters of the U.S. E.P.A. Office of Research and Development to Cincinnati, to be deputy director in the industrial environmental research laboratory. . . . **Donna D. Berman, M.C.P.** '72, formerly manager of the Massachusetts Port Authority Noise Abatement Office at Logan Airport, has joined Bolt, Beranek and Newman as a supervisory consultant. She is also active in working with citizen groups on environmental and transportation issues.

XII

Earth and Planetary Sciences

Tanya M. Atwater, who has collaborated with Woods Hole Oceanographic Institution on a number of recent oceanographic research cruises, has been promoted from assistant to associate professor. She came to M.I.T. in 1974 after a year as assistant professor at Scripps Institute of Oceanography, where she earned her Ph.D. in 1972.

Frank Press, who is on leave as Robert R. Shrock Professor of Geophysics to be President Jimmy Carter's science adviser, received the William Bowie Medal of the American Geophysical Union during its 1979 spring meeting. Professor Press was cited for "outstanding contributions to fundamental geophysics" and "unselfish cooperation in research."

Robert G. McKinney, '55, has been appointed assistant vice president and exploration manager in charge of the Midland, Texas, district office of Border Exploration Co. . . . **Francisco Querol-Surte, S.M.** '68, writes from Mexico: "I continue as professor of geology at the Facultad de Ingenieria of the National University of Mexico. I have been appointed chairman of the ore deposits department." . . . **William B. Farrington, Ph.D.** '53, recently wrote that after being single some 23 years he was married to Trudy Ebg in early 1979, and they plan to live in California.

John C. Gille, Ph.D. '64, writes that he is the "Co-Pb scientist on the Limb Infrared Monitor of the Stratosphere (LIMS) experiment launched on Nimbus 7 in October 1978." Data gathered will provide global temperatures, and amounts of ozone and other trace gases, all of which will help to clarify transport in and chemistry of the stratosphere. . . . **Robert M. Hazen**, '71, has recently edited *Early Writings* (on North American Geology), a series of benchmark papers on geology, published by Dowden, Hutchinson & Ross, Inc., and distributed by Academic Press, Inc. He is now with the Geophysical Laboratory in Washington, D.C.

David R. Wones, '54, is currently president of the Mineralogical Society of America while professor of geology in the Department of Geological Sciences at Virginia Polytechnic Institute and

State University in Blacksburg, Va. . . . **J. Edward White, Ph.D.** '49, is the Cecil H. Green Professor of Geophysics in the Colorado School of Mines. . . . **Frank T. Wheby**, '52, in his sixth year of practice as a consulting civil and geotechnical engineer in Evanston, Ill., is finding his training in geology and civil engineering an ideal combination for his work in the engineering problems of tunnels, slopes, shorelines, and foundations.

Cyril J. Galvin, Ph.D. '63, formerly chief, coastal processes branch and oceanographer, U.S. Army Coastal Engineering Center in Washington, D.C., and now practicing as a private coastal engineer, writes: "The fact that I was able to do my Ph.D. work in the civil engineering department while a member of your department (Geology and Geophysics) has been one of the most important influences on my technical career, and I continue to benefit from it."

Richard T. Lyons, '17, a longtime friend and benefactor of our geology department, died in Houston, Texas, on June 10, 1979. He and his wife, Sammie, who survives him, established the Richard and Sammie Lyons Fund in 1965 to help our geology undergraduates with the expenses of their summer field training. . . . A reprint of R. G. Luedke's memorial to **Wilbur S. Burbank**, '19, longtime geologist with the U.S. Geological Survey, is available free from the Geological Society of America, 3300 Penrose Pl., Boulder, CO 80301 — **Robert R. Shrock**, Professor Emeritus, M.I.T. Room 54-1026, Cambridge, MA 02139

XIII

Ocean Engineering

J. Kim Vandiver, Ph.D. '75, has been promoted from assistant to associate professor effective July 1. He was Doherty Assistant Professor of Ocean Utilization in 1976-78, specializing in offshore engineering systems pertinent to petroleum, ocean mining, and ocean energy conversion. Professor Vandiver came to M.I.T. for graduate study in 1968 from Harvey Mudd College; his doctorate in oceanographic engineering was awarded jointly by M.I.T. and Woods Hole.

Robert I. Price, N.E. '73, has advanced to vice admiral with the post of commander, Atlantic area and Third Coast Guard District, H.Q. in New York. . . . **John Huntly Boyd, N.E.** '59, has taken command of Puget Sound Naval Shipyard in Bremerton, Wash. . . . **Robert Leuschner, N.E.** '51, reports: "Have shifted jobs — no longer with Boland Marine, now instead research and development manager for Marine Industrial Cable Corp." . . . **Robert John Anderson, N.E.** '56, works in New York City as director of maintenance and repairs for Marine Transport Lines. . . . **Steven G. Buttner, S.M.** '72, serves as program manager of commercial new construction and navy overhauls at Bath Iron Works. . . . MITRE announces that **Alexander J. Tachmindji, S.M.** '51, is named vice president and general manager of the Washington command, control and communications operations.

XIV

Economics

Donald Ratajczak, Ph.D. '72, is professor of economics at Georgia State University and director of the Economic Forecasting Project. But that's not all: he also writes a weekly column for the *Atlanta Constitution*. . . . **Robert R. Kesel's**, Ph.D. '59, new creation is Kesel Associates, a turnkey systems firm and E.D.P. consultants for the metropolitan New York City area, specializing in total business systems using small-scale computers. . . . *Import Substitution, Trade and Development*, is a new book by **Jaleel Ahmad, Ph.D.** '65, published by Jai Press, Greenwich, Conn. . . . **Owen Irvine, Ph.D.** '76, writes, "I am an assistant professor of economics at Wesleyan University. Beginning in September, I will be visiting for a year at the Federal Reserve Board in Washington, D.C., where I will continue my research in applied macroeconomics."

Alice E. Kidder, Ph.D. '67, has been promoted to professor of economics at North Carolina A. and T. State University. . . . **David E. Kedder, Ph.D.** '67, recently joined the staff of A.B.T. Associates in Cambridge, Mass. . . . **David T. Scheffman, Ph.D.** '71, reports, "Visiting at F.T.C. Bureau of Economics, academic year 1979-80."

XV

Management

Four members of the Sloan School faculty have been promoted from assistant to associate professors, effective July 1: **Thomas A. Barocci**, **Stephen J. Kobrin**, **Nathaniel Mass**, '72, and **Jeffrey A. Meldman**, '65. Dr. Barocci, who taught at Cornell after studying at the University of Wisconsin, is a member of the Industrial Relations Section working on government-sponsored employment, training, and public works programs; he was chief economist in the Executive Office (Massachusetts) of Manpower Affairs in 1974-75 and special assistant to the director of the Regional Manpower Institute in 1975-76. Professor Kobrin's research focuses on the relationship between international business and politics; he studied management at Rensselaer and the University of Michigan (M.B.A. 1975), came to M.I.T. in 1975, and has been a research associate at the Center for International Studies since 1977. Professor Mass is associated with the system dynamics group, working on its national model project; his degrees are from M.I.T. in applied mathematics and management (Ph.D. 1975). Professor Meldman's field is legal problems related to management, especially privacy and computer-aided legal analysis; he holds degrees in electrical engineering from M.I.T. and the J.D. from the Harvard Law School, and he's a member of the adjunct faculties at Boston College Law School and the Franklin Pierce Law Center (Concord, N.H.).

Joseph Combs, S.M. '78, director of the M.I.T. Club of Chicago for 1978-79, recently joined Xerox Computer Services in suburban Chicago. . . . **James S. Andrasick, S.M.** '71, lives in Honolulu and works for C. Brewer and Co. as a vice president-planning and controller. . . . **Harvey C. Berger, S.M.** '76, was most recently an industrial relations representative for Fed Mart Stores in sunny southern California. . . . **Michael Jimenez, S.M.** '77, writes, "I have spent one year working on Exxon's project management team for a major refining expansion project in Venezuela, from the Irvine, Calif., office. For the next two years I will be control team manager at the project site in Venezuela." . . . **A. Edward Allinson, S.M.** '71, is senior vice president and trust executive of the Chase Manhattan bank.

Alberto Bautista, S.M. '75, works for Travenol Labs in Spain as plant manager. . . . **Charles E. Downing, S.M.** '58, is manufacturing engineering and development manager for Federal-Mogul Technical Center in Ann Arbor, Mich. . . . **Doyle Little, S.M.** '69, has been elected president of C.E.O. and director of O.P.I. — an international oil field service and manufacturing company. . . . **Enrique Garcia Corona, S.M.** '66, reports, "As of March 1, 1979, I have been appointed general manager of Werner and Pfeleiderer de Mexico. We handle machinery for the plastics, rubber, and bread industries." . . . **E. W. Kissel, S.M.** '75, was promoted to plant manager of Goodyear S.A. in Luxembourg last year.

Bob Jones, S.M. '77, started as assistant to the vice president of marketing at Baxter Travenol after his graduation. In June, 1978, he became a project manager. He writes, "I enjoy this considerably. Am also playing weekends in a five-piece rock group and enjoy motorcycling around the Midwest." . . . **Lisa M. Dickinson, S.M.** '77, works for Continental Illinois National Bank, International Banking Department, European Division. She used to cover the eastern European business, but was recently transferred to London. . . . **Roy N. Post, S.M.** '66, is manager of manufacturing systems for Georgia-Pacific Corp. He has also been promoted to commander, U.S. Naval Reserve.

XVI

Aeronautics and Astronautics

Edward M. Greitzer, an authority on surge and stall in axial flow compressors, and **Manuel Martinez-Sanchez**, Ph.D. '73, whose specialty is energy conversion systems, have been promoted from assistant to associate professors as of July 1. After studies at Harvard, Professor Greitzer worked with Pratt and Whitney Aircraft and United Technologies Research Center from 1969 to 1977, when he came to M.I.T.; he was at Cambridge University, England, in 1975-76. A native of Spain, Professor Martinez-Sanchez came to M.I.T. for graduate work in 1967, and he joined the faculty after completing his doctorate.

David W. Posich, S.M. '65, writes that he is senior product support engineer for the JT8D engine with Pratt and Whitney Aircraft. Last spring he coordinated an engineering and maintenance conference for the aircraft in Miami. . . . The director of facilities engineering at Rockwell International's corporate offices is **Roger K. Vance**, S.M. '67. . . . **Francis J. Hale**, Sc.D. '52, has been awarded the Outstanding Civilian Service Medal by the army. . . . **Arthur V. Sedrick, Jr.**, S.M. '68, is manager-solar research at Kalwall Corp. in New Hampshire. . . . **Peter M. Bainum**, S.M. '60, was elected vice president-technical for the American Astronautical Society for 1978-79. He is also vice president-research at W.H.F. and Associates and a professor of aerospace engineering at Howard University.

J. W. Leech, Ph.D. '58, is a solar specialist, international affairs with the D.O.E. . . . **Charles L. Wilson**, S.M. '63, reports, "Have returned from Shape, Belgium to be vice commander of the Acquisition Logistics Division, A.F. Logistics Command, Wright-Patterson Air Force base in Ohio, where I frequently see and work with Colonel Eugene Denezza, strategic S.P.O. deputy director, and Colonel Terry Jorris, in the U.S.A.F./R.D. — both of whom were classmates." . . . **Anil Jog-lekar**, S.M. '68 works as a research associate with the Institute for Defense Analyses. . . . **Carl Alexoff**, S.M. '56, has been promoted to president, Systems Operations, Inc., a subsidiary of Mathematica. He is also managing director of Interlot, B.V., a wholly owned subsidiary in Holland.

XVII

Political Science

Two members of the faculty have been promoted from assistant to associate professors effective July 1:

□ **Lloyd S. Etheredge**, who came to M.I.T. in 1975 from the University of Manitoba, holds degrees in economics, international relations, and political science from Oberlin and Yale (Ph.D. 1974). He is a specialist in political psychology, political behavior, and methods of political analysis.

□ **Martha W. Weinberg**, formerly assistant to the Massachusetts Secretary of Human Services (1972-73), is a student of state and local American politics and public policy. Her degrees are from Smith, the University of Wisconsin, and Harvard (Ph.D. 1974).

Professor **Lincoln P. Bloomfield**, on sabbatical leave, is now in charge of "global issues" as a member of the staff of the National Security Council; the appointment was announced by Zbigniew Brzezinski, the president's assistant for national security affairs.

Edwin Diamond's many magazine articles, television commentaries, and his book (*Good News, Bad News*) about the 1976 presidential campaign were cited by the Mellett Fund for a Free and Responsible Press in giving Mr. Diamond a "special commendation" in its first annual press-criticism competition late in the spring.

This is the first of a regular series of columns which will appear in *M.I.T.* '80 for the purpose of establishing contacts between alumni, and promoting the flow of information between us

about our progress, jobs, and career interests. M.I.T.'s Department of Political Science has been awarding graduate degrees for approximately fifteen years. Here is a look at the careers some of the alumni have chosen.

Academia: **Robert Bates**, Ph.D. '69, is professor political science at the California Institute of Technology . . . **Robert Berrier**, Ph.D. '78, is assistant professor of political science at the University of Pennsylvania . . . **Michael Brintnall**, Ph.D. '77, is assistant professor of political science at Brown University . . . **Judith Chubb**, Ph.D. '78, is assistant professor of political science at the College of the Holy Cross . . . **Vincent Ferraro**, Ph.D. '76, is assistant professor of politics at Mount Holyoke College . . . **Patrik Horan**, S.M. '68, is associate professor of sociology at the University of Georgia . . . **Carl Hosticka**, Ph.D. '76, is assistant professor in the School of Community Service and Public Affairs at the University of Oregon.

Karl Jackson, Ph.D. '71, is assistant professor of political science at the University of California at Berkeley . . . **Mary F. Katzenstein**, Ph.D. '75, is associate professor of government at Cornell University . . . **Peter Lange**, Ph.D. '75, is associate professor of government at Harvard University . . . **Irving Lefberg**, Ph.D. '78, is assistant professor of political science at the University of Washington . . . **Myron Levine**, Ph.D. '77, is assistant professor of political science at American University in Washington, D.C. . . . Col. **Franklin Margiotta**, Ph.D. '79, is director (dean) of curriculum, Air Command and Staff College, U.S.A.F. . . . **William Matthews**, Ph.D. '70, is director of the Environment and Policy Institute, East-West Center, Hawaii . . . **Cynthia McClintock**, Ph.D. '76, is assistant professor of political science at George Washington University.

Richard McDowell, S.M. '68, is dean, School of Management, Suffolk University . . . **Janice Perlman**, Ph.D. '71, is associate professor of city and regional planning at the University of California at Berkeley . . . Capt. **William Platte**, Ph.D. '71, is deputy to the president and dean of academics at the Naval War College in Rhode Island . . . **David Prindle**, Ph.D. '77, is assistant professor of political science at the University of Texas at Austin . . . **Jeffrey Raffel**, Ph.D. '72, is associate professor at the College of Urban Affairs and Public Policy at the University of Delaware . . . **Stuart Ross**, S.M. '67, is director of Marine Advisory Services at the University of Southern California, Los Angeles.

Herbert Rubin, Ph.D. '72, is associate professor of sociology at the Northern Illinois University in DeKalb, Ill. . . . **G. Earl Scharfenberger**, Ph.D. '80 (expected), is assistant professor of political science at Salem State College. . . . **Marvin Zonis**, Ph.D. '68 is associate professor of human development, University of Chicago.

Foundations and Research Institutions: **Tom Bryant**, S.M. '77, Ph.D. '80 (expected) is associated with the Center for International Studies at M.I.T., working on water resources management . . . **Ernest Evans**, Ph.D. '77, is with the Brookings Institution, writing a monograph on U.S. policy on terrorism . . . **Richard Rettig**, Ph.D. '67, is a senior social scientist at the Rand Corp., Washington, D.C. . . . **Enid Curtis Bok Schoettle**, Ph.D. '67, is program officer for the Ford Foundation . . . **John Steinbruner**, Ph.D. '68, is director of the Foreign Policy Studies Program at the Brookings Institution . . . **Paul Walker**, Ph.D. '78, is a research fellow at the Center for Science and International Affairs at the Kennedy School of Government, Harvard University.

Government: **Anne Cahn**, Ph.D. '71, is chief, Social Impact Staff of the U.S. Arms Control and Disarmament Agency . . . **Harrell Fuller**, S.M. '71, is a foreign service officer, chief of Human Resource Management Division in the Bureau of Personnel at the U.S. Department of State . . . **Charles Duelfer**, S.M. '77, is a budget examiner for Nuclear Forces and D.O.D. Space Program with the National Security Division of the Office of Management and Budget, Executive Office of the President . . . **Edward (Randy) Jayne II**, Ph.D. '69, is associate director for National Security and International Affairs, Office of Management and Budget, Executive Office of the President.

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John Mathiason, Ph.D. '68, is secretary, Working Group on Rural Development, Department of Technical Cooperation for Development, United Nations, N.Y. . . . **Lawrence McCray**, Ph.D. '74, is a regulatory reform analyst for the Environmental Protection Agency . . . **Edmund Parsons**, S.M. '70, is chief, Food Programs Division, Bureau of Economics, U.S. Department of State . . . **Meg Power**, Ph.D. '74, is minority counsel for the Subcommittee on Energy, Nuclear Proliferation and Federal Services, U.S. Senate Committee on Governmental Affairs . . . **David Rosenbloom**, Ph.D. '70, is commissioner of health and hospitals for the City of Boston . . . **Gordon Smith**, Ph.D. '66, is deputy secretary to the Cabinet (Plans), Government of Canada in Ottawa.

Private Sector: **Howard Arbesman**, S.M. '71, is public affairs advisor to Esso Production Malaysia, in Kuala Lumpur, Malaysia . . . **Rhonda Crane**, Ph.D. '78, is a supervisor, Corporate Planning, Strategic Policy Analysis, at the American Telephone and Telegraph Company, in N.Y. since 1976 . . . **Raymond Kelly**, S.M. '69, is president of R.F.K. Associates-International Consultant-Overseas Projects/Placement located in Bridgehampton, N.Y. . . . **Dana Mead**, Ph.D. '67, is director, Corporate Staffing and Personnel for the International Paper Company in N.Y. . . . **Alan Sloan**, Ph.D. '65, is president Avatar Learning Co. in Sherman Oaks, Calif. . . . **Neil Weiner**, S.M. '76, is an account executive for Merrill Lynch Pierce Fenner & Smith in Chicago, Ill. . . . **John Urmston, Jr.**, S.M. '78, is a political analyst for Bank of America in San Francisco, Calif.

Social Notes: **Robert Berrier**, Ph.D. '78, was married to Vanaja Ragavan, M.D., in June . . . **Tom Bryant**, S.M. '77, is engaged to **Robin Reenstra** (both Ph.D.s expected '80). Tom also found time to coach M.I.T.'s Rugby Club . . . **Neil Weiner**, S.M. '76, announced his engagement to Debra Gordon of Chicago, Ill. . . . **Karl Jackson**, Ph.D. '71, notes that his wife Virginia has gone back to teaching school and that they have three children: Colin, Andrea and Katherine. . . . **Peter Lange**, Ph.D. '75, served recently as president of the Cambridge Civic Association.

Janet Perlman, Ph.D. '71, plans to spend 1980-81 in New York City on sabbatical, would like to sublet an apartment or exchange homes for her Berkeley "mansion." . . . Captain **William Platte**, Ph.D. '71, plans to retire from the Naval Service late in 1979 and intends to work as a business, industrial, academic consultant. Keep us posted, Bill! . . . **Stuart Ross**, S.M. '67, is married and has two children as does **John Steinbruner**, Ph.D. '68. . . . **Enid Schoettl**, Ph.D. '67, writes that she has two sons, Michael and Derek. . . . **Matt Anderson** (Ph.D. expected) is enjoying sun, sea, and especially surf in California.

Publications: Apparently our political science alumni are prolific authors. We will be noting those remarkable accomplishments in forthcoming columns, as space permits.

Department of Political Science Alumni News/Meetings: The Department of Political Science is planning to publish a semi-annual newsletter, as many alumni have requested. Professor Pool and Elly Terlingen are coordinating this effort. Nonresident doctoral candidates are requested to please contact headquarters as tuition policy changes are in the offing. The first alumni get-together will be held in Professor Altschuler's suite at the A.P.S.A. meeting in Washington, D.C., in September.

Watch this column for further news and developments.

Career Opportunities: **Raymond Kelly**, S.M. '69, of R.F.K. Associates, Bridgehampton, N.Y. has opportunities for reconstruction planning for East Africa (Uganda, Sudan, Tanzania, Kenya) and Egypt eco-social development. He is especially interested in hearing from experienced Africanists.

Postscripts: Sincere thanks to all alumni who responded so promptly to the request for biographical information. It has been a pleasure to see familiar names and hear from old friends and acquaintances. We would like a volunteer who would be interested in assuming responsibilities for alumni activities west of the Rockies. No omission was intended in the letter sent to you!

We owe a special thanks to the M.I.T. Alumni Center of New York, Jim Bidigare, Vicki Spencer and Sharen Teitel who worked to send out and collate information for this column.

No, this isn't my job, just an activity which I felt was needed. Alumni who have not yet written to us, please take a moment to tell us about yourselves — promotions, grants, career changes, social events, opportunities, etc. — and send it to me. — **Dr. Rhonda Crane**, Ph.D. '78, Political Science Alumni Activities, M.I.T. Alumni Center of New York, 50 E. 41 St., New York, NY 10017

XVIII Mathematics

Professors **Louis N. Howard** and **Franklin P. Peterson** have begun their new assignments as chairmen, respectively, of the Committee on Applied Mathematics and Committee on Pure Mathematics in the Mathematics Department. The appointments were made by Professor Daniel J. Kleitman, and they became effective just as Professor Kleitman's assignment as head of the Department took effect on July 1.

Dorian Goldfeld, a specialist in analytic number theory, has been promoted from assistant to associate professor, effective July 1. He came to M.I.T. in 1976 after a year at the Institute for Advanced Study, Princeton, and two years at the Scuola Normale Superiore in Pisa, Italy; his degrees in pure mathematics are from Columbia University (Ph.D. 1969).

XIX Meteorology

Herbert Jacobowitz, Ph.D. '70, is senior scientist for the Nimbus 7 earth radiation budget experiment. . . . **P. R. Tatro**, Ph.D. '66, retired from the navy as captain in 1976. He is now manager, Ocean Science Division of Science Applications in McLean, Va. . . . **R. Grant Ingram**, Ph.D. '71, writes from Canada: "I am associate professor/ Marine Services Center at McGill University and research coordinator/Group Interuniversitaire de Recherches Oceanographiques in Quebec." . . . **Stephen D. Whitaker**, S.M. '77, has joined the Department of Energy's Solar Research Institute as a staff scientist. He will be creating computer models to forecast insolation (the amount of sunlight falling on a surface) data and devise analysis techniques for solar and meteorological data as related to wind and solar energy systems.

XX

Nutrition and Food Science

Leona Zacharias, director of research for the Human Maturation Study at Massachusetts General Hospital who is research associate in the department, and **William M. Rand**, senior research scientist in the department, have received a distinguished achievement award from the Education Press Association of America for their article, "American Girls: Their Growth and Development," in *National Elementary Principal* magazine last year.

Arthur Phillips, Sc.D. '47, has been with Syracuse University since 1955. He's now professor of microbiology in the Department of Biology. . . . News from **Bill Kan**, Ph.D. '57: "I have joined Access Group in Stamford, Conn., executive search consultants. I look forward to continuing my work with M.I.T. grads and the Alumni Association in presenting attractive new challenges to the mobile." . . . **Shirley M. Picardi**, S.M. '72, was recently promoted to be assistant director of the M.I.T. Industrial Liaison Program, where she has been employed since June, 1976.

Marijan A. Boskovic, S.M. '68, has an international background. She was formerly with Coca-Cola's eastern European region in Rome and has also been a senior instructor at the University of

Zagreb. Her newest assignment is as project leader with the Beverage and Breakfast Foods Division of General Foods. . . . **Kenneth A. Jones**, S.M. '72, is currently employed with Lever Brothers Co. in New York as associate group product manager involved in the development and marketing of new food products. . . . **Norman D. Heidelbaugh**, Ph.D. '70, has been appointed professor of food science and technology, and head of the Department of Veterinary Public Health at Texas A. and M. University. His main areas of activity are food safety, food toxicology and food stability.

XXI Humanities

It's a busy year for **John Harbison**, associate professor of music: two of his operas are having world premieres. "Winter's Tale," based on the Shakespeare classic, is opening in the War Memorial Auditorium, San Francisco, in August under auspices of the Western Opera Theater; and "Full Moon in March," a shorter work based on a verse-play by W. B. Yeats, was premiered at Sanders Theater, Harvard, by Musica Viva on April 30. The latter was Professor Harbison's first opera to reach the stage, and Richard Dyer of the *Boston Globe* said the music was "gorgeous — abundant, propulsive, individual-sounding, excitingly written for both voices and instruments, and intrinsically dramatic in its accent and color."

David Epstein, professor of music who directs the M.I.T. Symphony Orchestra, is the author of *Beyond Orpheus: Studies in Musical Structure*, published late last spring by the M.I.T. Press. The book is described as a study of the elements of musical structure and the ways they provide unity, coherence, and uniqueness in classic-romantic music.

Professor **Thomas H. D. Mahoney**, whose fourth term in the Massachusetts legislature ended early this year, has now been named Massachusetts Secretary of Elder Affairs by Governor Edward J. King. He'll continue — as he has as state legislator — part-time teaching in modern world history.

XXII Nuclear Engineering

Mujid S. Kazimi, Ph.D. '73, assistant professor of nuclear engineering, has been promoted to associate professor. Since coming to M.I.T. in 1976 he's continued work in the area of liquid metal fast breeder reactor safety which he began at Brookhaven National Laboratory in 1974-76; earlier he had worked for one year as senior engineer for Westinghouse Electric Corp. . . . **Charles V. Berney**, '54, senior research associate in the department, directed a production of Gilbert and Sullivan's *Mikado* for the M.I.T. Community Players this summer. The show was co-produced by alumni Jim Miller and Nick Nussbaum and featured several members of the M.I.T. community in the cast.

Arne P. Olson, Sc.D. '67, recently joined Science Application, Inc., in Oak Brook, Ill., as director of Engineering Services. . . . Carolyn and **Terry Simpson**, Sc.D. '70, announce the arrival of their first child, a beautiful baby girl, Anna Marie, born on October 20, 1978. . . . **Patrick G. Bailey**, Ph.D. '72, was previously employed as a staff member in the Thermal Reactor Safety Group at the Los Alamos Scientific Laboratory. He has now joined the Electric Power Research Institute as a project manager in the Nuclear Safety and Analysis Department. . . . **M. J. Harper**, S.M. '76, is a M.P.A. and weapons officer on nuclear-powered, fast attack submarine U.S.S. Lapon, homeported in Norfolk, Va. . . . **James L. Klucar**, Nu.E. '69, is the co-founder and vice president, engineering, of B.M.K. Services in Campbell, Calif. This is an engineering and construction company that specializes in mechanical and electrical design and modifications for commercial nuclear power plants.

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David J. Rose: An Optimistic Student of Man's Inadequate View of Technology

Professor David J. Rose, Ph.D. '50, "crosses more disciplinary boundaries in a day than most professors do in a lifetime," writes Joseph R. Egan in the Graduate Student Council's *The Graduate*. Mr. Egan — he is a graduate student in Professor Rose's Department of Nuclear Engineering — credits his mentor with "a rich and far-reaching perspective on socio-technological problems, commanding attention throughout the U.S. and around the globe."

So do Professor Rose's faculty colleagues, who honored him late last spring with the \$5,000 James R. Killian, Jr., Faculty Achievement Award for 1979-80. They cited him for contributions as scientist and engineer, technology/policy analyst, and "bridge-builder between the scientific and theological communities."

But such formal contributions alone are not enough to justify Professor Rose's admiration by students and colleagues. Consider Mr. Egan's report:

"A casual glance at Professor Rose's office chalk-board betrays his character. 'Do not take the name of thy professor in vain, lest thy assistantship disappear.' 'Vanity of vanity, all is vanity.' 'Do not write on the windows.' But at the bottom of the board, in blue, reads the simple phrase 'Ecclesiasticus 1:18,' which Dr. Rose hints is a constant reminder that, among other things, 'he who increaseth wisdom increaseth sorrow.'"

Professor Rose began his engineering career deeply involved in plasma technology, first as a graduate student at M.I.T., then on the technical staff at Bell Telephone Laboratories, and once more — after 1958 — at M.I.T. He was born and raised on Vancouver Island — "essentially in the woods, in constant communication with nature," Professor Rose told Mr. Egan. His undergraduate degree is in engineering physics from the University of British Columbia.

Professor Rose's compelling interest in socio-technological problems seems to date from 1969, when he was for two years director of the Office of Long Range Planning at Oak Ridge National Laboratory. As he told Mr. Egan,

"It became clear that there was a whole spectrum of problems that the country was facing . . . for which there was no adequate mechanism for understanding . . . for psyching out the options available, for bringing such options — even if they were prepared — to any kind of decision-making group, or for making any sort of coherent decision at all. Here were the nation's largest problem-solving organizations not looking at the nation's largest problems, or even at some of these problems."

Back at M.I.T., Professor Rose pursued his transition from a "scientific type to a policy type," as he puts it, by speaking out in seminars and classes, congressional testimony, conferences, and publications. He founded the undergraduate course on "Energy" which Mr. Egan calls "the most interdisciplinary conglomeration of any option-course at the Institute" and last year experimented with an interdepartmental lecture-seminar course called "The Finite Earth" (see June/July, pp. A30-31). And he organized a series of graduate subjects in energy policy, socio-technological problems and responses, and energy assessment.

At the same time, Professor Rose discovered that he was victim of emphysema, a progressive lung disease. "In a situation like this," he told Mr. Egan, "one gets a sense of urgency. It was pretty clear to me that there had to be some sort of change in values; that if I wanted to do something, I had better start doing it."

Enter now the National Council of Churches, whose anti-nuclear statement on "The Plutonium Economy" attracted Professor Rose's attention and ultimately led him to admire "the mature and global perspectives" of the National Council's parent World Council of Churches. So he became a moving leader of the W.C.C.'s conference on "Faith, Science, and the Future"



When they gave him the James R. Killian, Jr., Faculty Achievement Award, Professor David J. Rose's colleagues cited him for "three distinguished careers — scientist and engineer, technology/policy analyst, and bridge builder between the scientific and theological communities." For Joseph R. Egan, preparing a report for the Graduate Student Council's magazine, Professor Rose explained: "My views put me very much at odds with extremists . . . who take the view that man is inherently evil and therefore that his works are evil, out of which stems much of the anti-technology movement of today. I believe that man's works, as a part of creation, are conditionally good. It's up to us to create a world in which the good has a chance to surface." Photos: Marjorie Lyon

held at M.I.T. this summer.

"I learned from experience and introspection," Professor Rose told Mr. Egan, "that these [socio-technological] problems . . . cannot be entirely by the normal procedures of analysis, but that they have their ethical and moral dimensions; and it was the neglect of these dimensions that led to the problems in the first place. One has to face the questions, for example, of whether we are exploiters or stewards of the environment, whether we have short time horizons or long ones, whether we care about people even though they are out of sight and we can't write down their names. Approaching these questions by any route leads one eventually to a metaphysical dimension. The world, it seems, needs not only consciousness-raising, but conscience itself. The entire realm of non-analytic values needs a stronger role. Are we here just to wring what we can out of the system, or are we somehow partners of creation, partners of discovery?"

"As a society," someone in Mr. Egan's presence asks Professor Rose, "where do you think we're headed?"



Mr. Egan records Professor Rose's answer:

"I'd be a fool to try to predict that. Like Kenneth Boulding, I am what you call a despairing optimist; hoping for the best, but not too sure that we're going to get there. After all, what other position can one have? One who espouses pessimism will quit working. I try to search continually for a few people for whom it will be worthwhile to make the effort, and secondly, for a few people who not only have the ability and insight to be able to do something about the world's problems, but who will, in fact, take action. It doesn't take an army; sometimes an army would do nothing but get in the way — just as strapping 10,000 rockets together, each with a thrust of 0.9 g, will still never get anything off the ground. The very interesting developments in China over the recent years came about mainly through the efforts of two people: Mao Tse-tung and Chou En-lai. Sometimes it takes no more than that. In order to make big changes, you first have to get an idea of what might be possible, and then give the idea away so that those who are in the position to do something with it will 'think of it themselves.' That's why I like the education business. I see it mainly as a matter of helping people to develop themselves." — J.M.



G. S. Boolos



J. W. Bresnan



W. Busza



M. S. Feld



M. F. Garrett



J. A. Hausman



J. King



T. L. Magnanti



R. B. Melrose



J. W. Negele



R. S. Pindyck



R. Schmalensee



P. A. Sharp



A. Torriani-Gorini



E. H. Vanmarcke



R. E. Welsch

20 New Full Professors: M.I.T.'s Future Intellectual Leaders

Twenty members of the faculty, formerly associate professors, are now full professors — promoted as of July 1. They thus are designated by their faculty colleagues as being among the Institute's present and future intellectual leadership. The list:

□ **George S. Boolos**, Ph.D. '66, Department of Linguistics and Philosophy. Dr. Boolos, a specialist in logic and the philosophy of mathematics, returned to M.I.T. in 1969 after three years on the philosophy faculty at Columbia University; his undergraduate degrees are in mathematics (Princeton, 1961) and philosophy (Oxford, 1963).

□ **Joan W. Bresnan**, Ph.D. '72, Department of Linguistics and Philosophy. Dr. Bresnan came to M.I.T. from Reed College for graduate study in linguistic theory and cognitive processes, and she returned to the Institute in 1975 after teaching linguistics at Stanford and the University of Massachusetts, Amherst.

□ **Wit Busza**, Department of Physics. Dr. Busza, trained as an experimental particle physicist at University College, London, has pioneered research on the interaction of very energetic hadrons; he came to M.I.T. in 1969 from the Stanford Linear Accelerator Center.

□ **Michael S. Feld**, '63, Department of Physics. As director of the M.I.T. Spectroscopy Laboratory, Dr. Feld is widely known for his work in modern optics and high-precision laser spectroscopy. He began his career at M.I.T. with an undergraduate degree in the history and philosophy of science and joined the faculty in 1968 after completing graduate studies (S.M. '63, Ph.D. '67) in physics.

□ **Merrill F. Garrett**, Department of Psychology. A specialist in the relationship between mental processes and language use, Dr. Garrett holds degrees in psychology from Montana State University (B.S. 1959), speech from the University of Montana (M.A. 1960), and communication sciences from the University of Illinois, Urbana (Ph.D. 1965). He came to the Research Laboratory of Electronics in 1964 and joined the faculty

in psychology four years later.

□ **Jerry A. Hausman**, Department of Economics. Professor Hausman's specialty is the analytical field of econometrics; he's associate editor of *Econometrica* and the *Bell Journal of Economics*, and he is a reviewer for *Mathematical Review*. Professor Hausman's degrees in economics and economic history are from Brown (B.A. 1968) and Oxford (D.Phil. 1973).

□ **Charles E. Holt III**, Ph.D. '62, Department of Biology. The chief protagonist of research-oriented project laboratories for undergraduates in biology at M.I.T., Professor Holt's own research has centered on the physiology, biochemistry, and genetics of a slime mold which is the model for more general cases of biological differentiation and development. He came to M.I.T. from Wesleyan (B.A. 1957) and joined the faculty upon completing graduate work in biochemistry.

□ **Jonathan King**, Department of Biology. Dr. King is considered a leading student of the structural components of bacterial viruses. He studied at Yale (B.S. 1962) and California Institute of Technology (Ph.D. 1971), joined M.I.T. in 1971, and has recently been director of the Biology Department's electron microscopy facility.

□ **Richard C. Larson**, '65, Departments of Electrical Engineering and Computer Science and of Urban Studies and Planning. Co-director of the Operations Research Center at M.I.T. Professor Larson is known for analyses of public safety systems, especially police and ambulance allocation. He joined the faculty upon receiving his Ph.D. in electrical engineering.

□ **Thomas L. Magnanti**, Sloan School of Management. Starting with a degree in chemical engineering (B.S. Syracuse University, 1967), Professor Magnanti received two master's degrees in statistics and mathematics (Stanford, 1969 and 1972) and finally a doctorate in operations research (Stanford, 1972). Since then he has specialized in the application of operations research to managing high-technology projects and technologically-based industry.

□ **Richard B. Melrose**, Department of Mathematics. A widely respected mathematical analyst in the field of partial differ-

ential equations, Professor Melrose came to M.I.T. in 1976 after two years as research fellow at St. John's College, Cambridge. He has undergraduate degrees in mathematics and physics from the University of Tasmania (1968) and in theoretical physics from the Australian National University (1969); his doctorate in mathematics is from Cambridge University (1974).

□ **John W. Negele**, Department of Physics. A theoretical nuclear physicist, Dr. Negele studied engineering at Purdue (B.S. 1965) and theoretical physics at Cornell (Ph.D. 1969). At M.I.T. since 1970, he has contributed to a broad range of nuclear problems.

□ **Robert S. Pindyck**, '66, Sloan School of Management. Dr. Pindyck is a prolific student and writer on the economics of energy demand and production, and he is now beginning work in an entirely new area — the economics of epidemic control. He earned S.B. and S.M. (1967) degrees in electrical engineering and then moved to the Department of Economics for his doctorate (1971).

□ **Richard Schmalensee**, '65, Sloan School of Management. Professor Schmalensee began teaching in the Sloan School even before completing his Ph.D. in economics (1970), and since then he has established himself as a specialist in problems of industrial organization and government regulation of industry. He returned to the Sloan School in 1977 following seven years at the University of California in San Diego.

□ **Stephen D. Senturia**, Ph.D. '66, Department of Electrical Engineering and Computer Science. Professor Senturia is credited with the development of several key undergraduate subjects in the department as well as with significant research on semiconductor materials and applications since he joined the faculty in 1967. His undergraduate studies were at Harvard (B.A. 1961).

□ **Phillip A. Sharp**, Department of Biology. Professor Sharp's work on RNA splicing — the transcription of genetic information — has had major impact on the field, and his earlier work on virus infection of mammalian cells is also widely recognized. Professor Sharp studied at Union College (Barbourville, Ky.) and the University of Illinois

With the Alumnae

Ann M. Beha, '75, who has owned her own historic preservation and design company in Boston for several years now, has worked on a variety of such projects all over New England and New York. Currently, her work is focused in Harvard Square, where she is the owner's representative for the restoration of the Blacksmith House Bakery Shoppe, and simultaneously embarking on Phase II of the restoration of the Cambridge Center for Adult Education's familiar structure at 42 Brattle Street — two projects which she says she's enjoying "very much."

A.M.I.T.A. is looking forward to the annual dinner meeting held in conjunction with the Alumni Officers Conference on September 29. Plans are underway now for an informative, interactive gathering with alumnae members of the M.I.T. Corporation Visiting Committees. The dinner will be held in the Emma Rogers Room, and reservations may be made by writing or calling Beth Greene at the Alumni Center, Room 10 — 115, or at (617) 253-8221. This is an unprecedented opportunity for alumnae to learn about the concerns of those on these important committees, described as "arms of the Corporation."

One alumna on the Visiting Committee for Linguistics and Philosophy will be unable to join the A.M.I.T.A./A.O.C. meeting, but **Barbara Hall Partee**, '65, looks forward to an interesting September. Barbara, a professor in the University of Massachusetts's Department of Linguistics, will be presenting a series of lectures in Seoul and other Korean cities, in conjunction with the Annual Meeting of the Korean Linguistics Society. Barbara's field is theoretical linguistics.

Let other alumnae know what you're doing — communicate with other alumnae by means of this column. — **Elizabeth Greene**, Alumni Center, M.I.T. Room 10-115, Cambridge, MA 02139, (617) 253-8221.

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(Ph.D. 1969) and held posts at California Institute of Technology and Cold Spring Harbor laboratory before coming to M.I.T. in 1974.

□ **Richard P. Stanley**, Department of Mathematics. After undergraduate work at California Institute of Technology (B.S. 1966) and graduate study at Harvard (Ph.D. 1971), Dr. Stanley was research fellow at the University of California, Berkeley, for two years before joining the faculty at M.I.T. in 1973. His research in combinatorics and computer science bridges the gap between pure and applied mathematics.

□ **Annamaria Torriani-Gorini**, Department of Biology. A native of Italy trained at the University of Milan (Ph.D. 1942), Dr. Torriani-Gorini came to M.I.T. in 1960 as research associate. Since then she has made major contributions to the fields of bacterial physiology and the molecular biology of bacteria.

□ **Erik H. Vanmarcke**, Ph.D. '70, Department of Civil Engineering. Professor Vanmarcke is ranked among the leaders in applying formal probabilistic methods to civil engineering problems and practice; he is head of the department's Systems Methodology Group. A native of Belgium, Professor Vanmarcke holds graduate degrees from M.I.T. and the University of Delaware (M.S. 1967) and joined the faculty in 1969.

□ **Roy E. Welsch**, Sloan School of Management. Applications to managerial problems of modern statistical research are the

specialty of Professor Welsch, who's been at M.I.T. since 1969. He studied mathematics at Princeton (A.B. 1965) and Stanford (M.S. 1966, Ph.D. 1969).

Eight New Members Among 14 Changes on the Corporation

Eight new faces will be among those present when the M.I.T. Corporation convenes for the first of its quarterly meetings of 1979-80 on October 3; all were elected by their soon-to-be colleagues on June 4 at a breakfast meeting preceding Commencement. The new members:

□ **Herman R. Branson**, president of Lincoln University (Penn.). A physicist, Dr. Branson studied at the University of Cincinnati; he's a trustee of the Carver Research Foundation at Tuskegee Institute, the Woodrow Wilson National Fellowship Foundation, and National Medical Fellowships, Inc., of which he is treasurer.

□ **Claude W. Brenner**, '47, vice president — operations of the Northeast Solar Energy Center. Mr. Brenner joins the Corporation ex-officio as president (1979-80) of the Alumni Association.

□ **Paulette Coleman**, Ph.D. '77, assistant professor in the Department of Community and Regional Planning and the Center for African and Afro-American Studies and Research at the University of Texas, Austin. Dr. Coleman's M.I.T. degree is in the field of urban studies and planning; she expects to



M. Pierce



W. S. Richardson



E. D. Becken

complete requirements for a J.D. degree from the University of Texas in 1980.

□ **Ida M. Green** of Dallas, Texas. With her husband, Cecil H. Green, '23, Ms. Green has been a generous supporter of M.I.T. for more than two decades; her name is associated with the Green Building for earth sciences, the Cecil and Ida Green Professorships, and the Ida M. Green Fellowships for women in science and engineering. She and Mr. Green were together recipients of the 1979 Public Welfare Medal of the National Academy of Sciences. Ms. Green's election was to the rank of life member.

□ **S. James Goldstein**, '47, founder and managing partner of James Goldstein and Partners, architects, of Millburn, N.J. He is active in alumni affairs, co-chairman for New York of the \$225 million Leadership Campaign, and chairman of the Corporation Visiting Committee for the Libraries. Mr. Goldstein was nominated for Corporation membership by fellow alumni.

□ **Barbara W. Newell**, president of Wellesley College. Dr. Newell, an economist, has been president of Wellesley since 1972; she is also a trustee of the Carnegie Foundation for the Advancement of Teaching, the Boston Symphony Orchestra, and the Carnegie Endowment for International Peace.

□ **J. Paul Sticht**, chairman and chief executive officer of R. J. Reynolds Industries, Inc., Winston-Salem, N.C. Mr. Sticht studied at Grove City (Penn.) College, of which he is now a trustee; he's also a trustee of Rockefeller University, the Committee for Economic Development, and Old Salem, Inc. (N.C.).

□ **Emily V. Wade**, '45, of Bedford, Mass., active in Greater Boston public service and conservation organizations. In addition to her many assignments in the Alumni Association (by which she was nominated to the Corporation) and the Association of M.I.T. Alumnae, Ms. Wade is a member of the Corporation Development Committee and chairman of the M.I.T. Sea Grant's State-Industry Council.

At the same meeting of the Corporation, **Helen F. Whitaker** of Naples, Fla., was named a life member of the group, and five members were re-elected: **Frank T. Cary**, chairman and chief executive officer of

I.B.M. Corp., **Edward E. David, Jr.**, Sc.D. '50, president of Exxon Research and Engineering Co., **Maurice F. Granville**, S.M. '39, chairman and chief executive officer of Texaco, Inc., **Joe F. Moore**, '52, president of Bonner and Moore Associates, Inc., Houston, and **Thornton A. Wilson**, S.M. '53, chairman and chief executive officer of the Boeing Co.

Selection Committee

Three alumni, elected in a national ballot of their fellow-members of the Alumni Association, have joined the National Selection Committee for 1980; their job will be to help choose the Association's officers for 1980-81. The new members:

□ **Marjorie Pierce**, '22, practicing architect of Weston, Mass.

□ **William S. Richardson**, '44, president of A. R. Wright Co. (petroleum products distributors), Cape Elizabeth, Maine.

□ **Eugene D. Becken**, S.M. '52, former president and chairman of RCA Global Communications, New York.

Individuals Noteworthy

Rising and Changing in the World of Business

Charles C. Francisco, '59, elected a vice president of E.G.&G. with responsibilities for the Environmental Group . . . **Samuel Rubinovitz**, '51, also elected a vice president of E.G.&G. with responsibility for the Electron Devices Group . . . **Howard Mandelbaum**, S.M. '65, appointed senior vice president of William Douglas McAdams . . . **Anthony Turano, Jr.**, '54, named vice president-corporate planning at Commonwealth Oil Refining Co. in San Antonio, Texas . . . **George Harrison**, '61, named assistant vice president of Merrill Lynch, Pierce, Fenner and Smith.

Eugene D. Scalera, '52, formerly a division vice president, named president of G.T.R. Foam Products Co. . . . **James Bochnowski**, '65, vice president and chief operating officer at Shugart, takes on additional responsibilities as president and chief executive officer . . . **Bill Wong**, '70,

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named a vice president of National Bank of North America . . . **James C. Pennypacker**, '60, named a vice president in the Trust and Investment Division of Chemical Bank . . . **John D. Sorrell**, '50, elected secretary of Insurance Co. of North America . . . **James M. Ewell**, '37, senior vice president, plans to retire from Procter and Gamble . . . **Sanford G. Weiner**, '61, currently advertising manager, appointed manager, bar soap and household cleaning products, at Procter and Gamble.

Robert O. Bigelow, '49, named a vice president of New England Power Co. . . . **Richard H. Oeler**, '60, appointed general manager for the Environmental and Metallurgical Systems Department at Air Products . . . **Bruce D. Glabe**, '69, elected controller of Bolt, Beranek and Newman . . . **David W. Kress**, '67, named to the newly created position of manager of new product marketing for Analog Devices Semiconductor . . . **David D. Withee**, '74, promoted to national manager of educational materials for Junior Achievement, responsible for the writing and development of all printed materials and audio-visuals . . . **Joseph P. DiLiberto**, '70, named manager of advanced engineering technology for Monroe, the calculator company.

Paul E. Schindler, Jr., '74, formerly of the *Oregon Journal* and U.P.I., appointed West Coast editor of *Computer Systems News*, based in Cupertino, Calif. . . . **Gordon Aitken**, '54, promoted to director of engineering at International Salt's headquarters . . . **Andrew F. Corry**, '44, named a senior vice president with Boston Edison Co. . . . **Richard R. Raven**, '43, promoted from technical manager to vice president of engineering at Bath Iron Works . . . **Frederick J. Bumpus**, '51, elected president and chief operating officer of Arkwright-Boston Manufacturers Mutual Insurance Co. and also named a director . . . **Daniel S. Diamond**, '65, promoted to manager of office automation marketing at Honeywell's Small/Medium Information Systems Division.

Counselors: Officers, Directors, Advisors

William C. MacInnes, '26, named chairman of Tampa Electric Co. . . . **John D. Maxwell**, '39, elected chairman of Kollmorgen Corp. . . . **Philip Spertus**, '56, appointed chairman of Intercraft Industries Corp., and continues as chief executive officer . . . **John Sterner**, '33, elected vice chairman of Cordis Corp. . . . **Guy A. Carbone**, '57, named to metropolitan district commissioner by Governor King . . . **Robert W. Wisleder**, '64, appointed executive assistant to the director of the Transportation Systems Center of the U.S. Department of Transportation.

Vytautas Klemas, '58, promoted to full professor of marine studies at the University of Delaware . . . **Kenneth S. Brock**, '48, appointed director of capital and special projects in the Office of Development at New York Hospital-Cornell Medical Center . . .

Elmer J. Roth, '35, most recently chief financial officer for New England College, named executive vice president of Nasson College . . . **Walter J. Humann**, '59, president and chief executive officer of Hunt Investment Corp., elected to the Rand Corp. board of trustees.

Angelo R. Arena, '49, president and chief executive officer of Marshall Field and Co., elected to the board of Harris Bankcorp, the Chicago bank holding company . . . **J. Robert Gunther**, '43, chairman and president of George Schmitt and Co. was elected a director of Northeast Bancorp . . . **D. Reid Weedon, Jr.**, '41, elected director of the Rowe Price New Horizons Fund . . . **Peter T. Van Aken**, '63, named vice president of budget and analytical services at Brandeis University.

Edwin G. Eigel, Jr., '54, academic vice president of Louis University, named vice president for academic affairs at the University of Bridgeport . . . **A. Wentworth Erickson**, '28, appointed to a three-year term as chairman of Barrington College's board of trustees . . . **Lloyd D. Brace**, '56, appointed director of trade adjustment assistance of the Maine Development Foundation.

Kudos: Honors, Awards, Citations

Thomas M. Devine, '70, metallurgist at the General Electric Research and Development Center, one of the winners of the 1979 Joseph R. Vilella Award of the American Society for Testing and Materials . . . **Matt Lebenbaum**, '45, vice president of Cutler-Hammer's AIL Division has received the Outstanding Engineering Manager Award from the Long Island Section of the Institute of Electrical and Electronics Engineers . . . **Ralph E. Cross**, '33, chairman of the Cross and Trecker Corp., elected an honorary member of the Society of Manufacturing Engineers.

Richard L. Steiner, '39, elected to life membership in the American Society of Civil Engineers . . . **Bryan F. Smith**, '42, has received a Doctor of Laws degree from the University of Dallas . . . to **Vincent L. McKusick**, '47, chief justice of the Maine Supreme Court and former chairman of the board of editors of the *American Bar Association Journal*, an honorary Doctor of Laws from Bowdoin College . . . to **I. M. Pei**, '40, the Gold Medal of the American Institute of Architects . . . **Russell G. Meyerand, Jr.**, '55, director of research for United Technologies Corp., the Connecticut Patent Law Association's 1979 Eli Whitney Award . . . to **Robert C. Cowen**, '49, science writer and science editor at the *Christian Science Monitor*, the 1979 American Institute of Physics-United States Steel Foundation Science-Writing Award in Physics and Astronomy . . . to **Rene W. Luft**, Sc.D. '71, an associate with Simpson Gumperts and Heger, the Massachusetts Young Engineer of the Year Award for 1978.

New members of the National Academy of Engineering: **Bernard B. Berger**, '35, pro-

fessor of civil engineering, University of Massachusetts; **Donald C. Berkey**, '42, vice president and general manager, Energy Systems and Technology Division of General Electric Co.; **Oliver C. Boileau**, S.M. '64, president Boeing Aerospace Co.; **Peter Elias**, '44, professor of electrical engineering, M.I.T.; **Robert R. Everett**, '43, president, Mitre Corporation; **Iain Finnie**, Sc.D. '50, professor of mechanical engineering, University of California, Berkeley; **Robert G. Gallager**, '57, professor of electrical engineering and computer science, M.I.T.; **Eugene I. Gordon**, Ph.D. '57, director of the Integrated Circuit Customer Application Laboratory, Bell Laboratories; **Kenneth F. Holtby**, S.M. '62, vice president for new programs, Boeing; **Frederick J. Hooven**, '27, professor of engineering, Thayer School of Engineering; **Edward R. Kane**, '43, president, E. I. du Pont de Nemours and Co.; **Edward W. Kimbark**, '33, consulting engineer, Bonneville Power Administration; **William K. Linvill**, '45, professor and chairman, Department of Engineering (Economic Systems), Stanford University; **Max V. Mathews**, S.M. '52, director of Acoustical and Behavioral Research Center, Bell Telephone Laboratories; **Robert D. Maurer**, Ph.D. '51, research fellow, Corning Glass Works; **William J. McCune, Jr.**, '47, president and chief operating officer, Polaroid Corp.; **Arthur B. Metzner**, Sc.D. '51, professor of chemical engineering, University of Delaware; **Alan S. Michaels**, '44, professor of chemical engineering, Stanford University; **J. Edward Snyder, Jr.**, S.M. '55, oceanographer of the Navy; **Alexander Squire**, '39 of Richland, Wash.; **Francis M. Staszsky**, '42, executive vice president and director, Boston Edison Co.; **Theodore Stern**, '67, executive vice president, Westinghouse Electric Corp.; **Marshall P. Tulin**, '46, chairman of the board, Hydronautics, Inc. . . . Foreign Associates of the Academy: **Tasuku Fuwa**, Sc.D. '58, professor, chair for ferrous process metallurgy and head, Department of Metallurgy, Tohoku, Sendai, Japan; **Robert S. Silver**, '62, James Watt Professor of Thermodynamics and head, Department of Mechanical Engineering, University of Glasgow, Scotland.

Honors and Awards to the M.I.T. Family

Carmen N. Besterman, special assistant to the chairman of the M.I.T. Corporation, to the Governor's Commission on the Status of Women . . . to **James W. Coleman**, director of the Graphic Arts Service, a citation from the Cambridge School Committee for his help in updating printing equipment in the Occupational Education Department of Cambridge Rindge and Latin School . . . to **Edward M. Greitzer**, assistant professor of aeronautics and astronautics, the Gas Turbine Award of the American Society of Mechanical Engineers . . . to **Cecil H. Green**, '23, and **Ida M. Green**, the Public Welfare Medal of the National Academy of

Sciences "for their outstanding role as discriminating donors, seeking those opportunities where their support of science could make a qualitative difference — to people and to institutions" . . . **Robert S. Harris**, '28, professor of nutritional biochemistry, emeritus, is a fellow of the American Institute of Nutrition . . . **Jay K. Lucker**, director of libraries, to the Advisory Board of Chemical Abstracts Service . . . to **Susan K. Nutter**, associate engineering librarian, an academic library management internship from the Council on Library Resources.

Harriet Pearce, women's athletic trainer, to the 1980 Winter Olympics sports medicine staff . . . **Franklin P. Peterson**, professor of mathematics, will be in China in 1979-80 under the Senior Scholar Research Program of the U.S. Committee on Scholarly Communication . . . **George W. Rathjens**, professor of political science, to a Massachusetts panel on the implications of the Three Mile Island nuclear accident . . . to **John G. Sclater**, professor of marine geophysics, the \$5,000 Rosenstiel Award in Oceanographic Science from the Rosenstiel School of Marine and Atmospheric Science, University of Miami . . . to **Irwin I. Shapiro**, professor of physics and geophysics, the \$5,000 Benjamin Apthorp Gould Prize of the National Academy of Sciences "for observations characterized by ingenuity and precision in solar system tests of general relativity." . . . to **Ioannis V. Yannas**, S.M. '59, the annual award of the Hellenic Medical Society of New York for outstanding contributions to the medical profession. . . . to **Edwin F. Taylor**, senior research scientist in the Department of Physics, the distinguished service citation of the American Association of Physics Teachers for his five years as editor of the Association's *American Journal of Physics*.

Eight members of the M.I.T. faculty and staff will have Guggenheim Fellowships for research in 1979-80: **Suzanne Berger**, professor of political science (changes in the politics of French Catholics, 1958-1978); **Kenneth Brecher**, associate professor of physics (theoretical high-energy astrophysics); **Lloyd Demetrius**, research associate in mathematics (application of thermodynamic theory to ecological systems); **Rudiger Dornbusch**, professor of economics (the economics of flexible exchange rates); **Kenneth Keniston**, Andrew W. Mellon Professor of Human Development (technological mentality in student engineers); **Steven L. Kleiman**, professor of mathematics (enumerative geometry); and **Peter Molnar**, associate professor of earth sciences (continental tectonics).

Suzann R. Thomas Buckle, Ph.D. '74, and **Leonard G. Buckle**, '64, both associate professors of urban studies and planning, hold German/Marshall Fund Fellowships for 1979-80; their research will be on Neighborhood Justice Centers. . . . **Julian Szekely**, professor of materials engineering, was 1979 Howe Memorial Lecturer for the Iron and Steel Society.

Two operas by **John Harbison**, associate

professor of music, will have premieres in 1979. "Full Moon in March," based on a play by W. B. Yeats, was first given in Cambridge on April 30, and "Winter's Tale," based on the Shakespeare play, will be performed by the Western Opera Theater, a division of the San Francisco Opera, on August 25-28 with the composer conducting.

Robert W. Mann, '50, Whitaker Professor of biomedical engineering, became the 37th recipient of the New England Award from the Engineering Societies of New England. . . . The American Society of Mechanical Engineers has honored two faculty members: to **Frank A. McClintock**, professor of mechanical engineering, the Nadai Award; to **Robert O. Ritchie**, associate professor of mechanical engineering, the Best Paper Award for his article in the July, 1977, issue of the *Journal of Engineering Materials and Technology*, "Near-Threshold Fatigue Crack Propagation in Ultra High Strength Steel: Influence of Load Ratio and Cyclic Strength."

Alfred P. Sloan Fellows: **Paul L. Houston**, Ph.D. '73, of Cornell University; **F. Read McFeely**, assistant professor of chemistry at M.I.T.; **Eugene B. Trubowitz**, assistant professor of mathematics at M.I.T.

New Appointments at M.I.T.

Edwin F. Taylor, former editor of the *American Journal of Physics* who is senior research scientist in the Department of Physics and in the Division for Study and Research in Education, is now director of M.I.T. Educational Video Resources. Dr. Taylor's new job is "to expand the use of video in the Institute's regular educational programs and develop new uses and programs in response to M.I.T. needs."

Robert M. Dankese, fiscal planning officer in the Fiscal Planning and Budget Office, has been promoted to Associate Budget Director . . . **Patricia A. Garrison** is now director of Personnel Services, succeeding **Claudia B. Liebesny**, who is on leave to attend the 1979-80 Sloan Fellows Program . . . **James J. Culliton** is now director of personnel as well as assistant to the vice president for administration and personnel . . . **Frederick P. Gross**, '73, and **Harry E. Stephens III**, S.M. '74, have been named industrial liaison officers; Mr. Gross came from the Massachusetts Department of Environmental Management, Mr. Stephens from United Technologies Corp. . . . **Susan Warshauer** is now senior consultant/trainer in the Office of Personnel Development.

Changes at M.I.T.

J. Michael Gallagher, who's held a variety of planning and energy assessment posts at Bechtel National, Inc., has been loaned to M.I.T. to serve as technical director of a new World Coal Study involving 60 technical people from 15 countries. . . . **Howard W. Johnson**, Chairman of the M.I.T. Corporation, is a member of the Advisory Board of

the National Center for Economic Education of Children. . . . Under a fellowship from the Council on Library Resources, **Mary E. Pensyl** of the M.I.T. Libraries is studying user demands on reference departments of academic and research libraries. . . . **Eva I. Kampits**, administrative officer of the Laboratory for Computer Science at M.I.T., is now assistant to the director; and **Thomas E. Lightburn**, former fiscal officer, is administrative officer. . . . **Nina Salloway**, formerly manager of cable television services at M.I.T., is now associate director of educational video resources.

Louis S. Scaturro, 1951-1979

Louis S. Scaturro, assistant professor of nuclear engineering who was a member of the Plasma Fusion Center, died unexpectedly at his home on May 16. The victim of a heart attack, he was 28.

Professor Scaturro was considered to be an expert in his field — study of the details of power loss in plasmas. His recent work in this area had gained him national attention in the context of the national program for the development of fusion power.

A graduate of Cooper Union for the Advancement of Science and Art (B.S., 1972), Dr. Scaturro came to M.I.T. in 1976 immediately after receiving his Ph.D. in plasma physics from Columbia University.

Deceased

Charles F. Robinson, '10; April 17, 1979; 32 Oxford St., Arlington, Mass.

Walter T. Spalding, '10; January 13, 1979; 3340 Pacific Heights Rd., Honolulu, Hi.

John S. Selfridge, '12; November, 1978; P.O. Box 1037, Ross, Calif.

Dr. Ralph B. Kennard, '13; November 6, 1978; 1207 Rossmoor Tower I, Laguna Hills, Calif.

Percy W. Moody, '15; April 11, 1979; 95 Sunset Rock Rd., Andover, Mass.

Raymond B. Stringfield, '15; June 15, 1979; c/o Dorothy Dorn, 1923 Park Ave., Los Angeles, Calif.

Theron S. Curtis, '16; April 22, 1979; 59 Chapin Rd., Barrington, R.I.

Charles R. Lord, '16; August 24, 1978; 238 Rutledge Ave., East Orange, N.J.

Merrill E. Pratt, '16; November 23, 1978; 1319 Magnolia Curve, Montgomery, Ala.

George W. Waymouth, '16; April 23, 1979; 12415 103rd Ave., No. F-68, Sun City, Ariz.

Richard T. Lyons, '17; June 10, 1979; 5609 Tupper Lake Dr., Houston, Texas

Clarence C. Fuller, '18; May 26, 1979; 70 Granite St., Foxboro, Mass.

Edward A. Mead, '18; May 1, 1979; Heritage Village 1042A, Southbury, Conn.

Professor Herbert W. Best, '19; September 28, 1977

Phillip J. Byrne, Jr., '20; September 18, 1978; 28 Canterbury Ln., Westfield, N.J.

Donald B. Kimball, '20; April 27, 1979; 2500 East Ave., Rochester, N.Y.

John de Meulenaer, '20; May 10, 1979; 21 Owencroft Rd., Dorchester, Mass.

Ralph M. Shaw, Jr., '21; May 20, 1979; 137 E. Warren St., Beverly, N.J.

E. Austin Rice, '22; February 27, 1979; 6837 Chadbourne, North Olmstead, Ohio

Howard M. Spooner, '22; November 18, 1978; 10 Nassau Dr., P.O. Box 415, Summit, N.J.

Harland A. Wilbur, '22; June 2, 1979; 11 Cambridge St., Winchester, Mass

Col. Frank J. Atwood, '23; May 1, 1979; 3361 S. Leisure World Blvd., Rossmoor, Silver Spring, Md.

Edgar D. Deming, '23; August, 1978; 30 Wilshire Park, Needham, Mass.

Brig. Gen. Harris Jones, '23; July 1, 1977; 40 Gertrude Pl., Asheville, N.C.

Cmdr. Joseph Christoph, '24; May 2, 1979; 27 Lakewood Circle South, Manchester, Conn.

Ray S. Hamilton, '24; November, 1978; Wirtz, Va.

William C. McHenry, '24; April 4, 1978; 131 E. 69th St., Apt. 10A; New York, N.Y.

R. Newell Waters, '24; January 10, 1979; 1715 Tex Blvd., Weslaco, Texas

Frederick S. Brown, '25; May 9, 1979; 37-B Middlesex Cir., Waltham, Mass.

Anthony P. Gabrenas, '26; August 16, 1977; 8700 S.W. 87th Ave., Miami, Fla.

Francis L. Ford, '27; June 12, 1979; 1407 Floral Ave., Fairlawn, N.J.

James A. Lyles, '27; June 5, 1979; Lawrence House, Canaan, Conn.

Gilbert J. Ackerman, '28; April 8, 1979; 103 West 31st Ave., Kennewick, Wash.

R. Preston Carter, '28; April 24, 1979; 826 Thistledown Dr., Memphis, Tenn.

Norman L. Fournier, '28; March 22, 1979; 239 Red Clay Rd., No. 102, Laurel, Md.

Walter K. Grimwood, '28; February 21, 1979; 2523 St. Paul Blvd., Rochester, N.Y.

Kenneth L. Horgan, '29; March 10, 1979; 9081 Thunderbird Dr., Coral Springs, Fla.

Kenneth W. Litaker, '30; June 5, 1979; 42 Aurora Ln., South Yarmouth, Mass.

Professor Sidney McCuskey, '30; April 22, 1979; 118 Rutherford Rd., Cleveland, Ohio

George Nides, '30; May 3, 1979; 2319 Crescent St., Long Island City, N.Y.

Robert T. Sauerwein, '30; January 9, 1978; 6 Westmont, West Hartford, Conn.

Gerald A. Benoit, '31; July 8, 1978; 548 Dennison Dr., Southbridge, Mass.

Leland E. Gibbs, '31; April 30, 1979; 6441 Dix Rd., No. 1, Rome, N.Y.

Capt. J. Thomas Howard, '31; May 31, 1978; 2195 Wappoo Dr., Charleston, S.C.

Frederick F. Aldridge, '33; June 2, 1979; 14046 S.W. 275th St., Naranja Lakes, Fla.

George H. Bartlett, '33; May 11, 1979; P.O. Box 423, Scarborough, Maine

Arthur T. Mason, '33; November 17, 1978; 183 Morrison Dr., Apt. 2, Pittsburgh, Penn.

Fred L. Haas, '34; October 24, 1977; 4477 18th St., Wyandotte Mich.

Simeon Van T. Jester, Jr., '34; May 17, 1979; 104 Dora Ave., Waldwick, N.J.

Dr. Warren K. Lewis, Jr., '34; April 18, 1979; 1233 Terrace Dr., Rt. 3, Salem, Va.

Kevin Malone, '34; May 31, 1979; 3344 S.W. 108th St., Beaverton, Ore.

A. Rufus Applegarth, Jr., '35; May 10, 1979; English Village Apts, No. 8A7, Lower State

Rd., North Wales, Penn.

Frank G. Marble, '35; April 25, 1979; 3704 Northridge Dr., Concord, Calif.

William F. Schult, '35; June 14, 1979

Herbert Small, '35; April, 1978; c/o Carol Wilson, 116 W. Cushing St., Tucson, Ariz.

John A. Easton, Jr., '36; May 30, 1979; Rt. 131, Tenants Harbor, Maine

Hannah C. Moody, '36; December 10, 1978; 1481 Hollywood Dr., Lancaster, Penn.

George V. Schlietett, 'March 30, 1979; 6713 Pemberton St., Bethesda, Md.

Teh Ching Li, '37; 1968

Ezriel Post, '37; April 3, 1979; 60 Pond Rd., Bldg. G, Woodbury, N.Y.

J. David Baker, '38; April, 1979; 7410 Holli-day Dr., West, Indianapolis, Ind.

John A. Doremus IV, '38; May 16, 1979; 4380 Felter Rd., Milpitas, Calif.

Elwood L. McGee, '41; May, 1979; River-view Rd., R.R. No. 2, Gates Mills, Ohio

Hans W. Aschaffenburg, '42; May 29, 1979; 155 Heaths Bridge, Concord, Mass.

Dr. Charles H. Davenport, '42; March 19, 1978; 3461 Stonebridge Rd., Dayton, Ohio

Professor Deane Lent, '42; April 9, 1975; 9 Little Harbor Rd., Cohasset, Mass.

Merwin R. Burman, '46; December 10, 1978; 278 Linden Park Pl., Highland Park, Ill.

George E. Bierce, Jr., '47; January 27, 1977; 20 Winding Way, Stratford, N.J.

Trafton H. Bean, '48; March 25, 1979; 2221 4th St., Boulder, Colo.

Alfred S. Gutman, '48; June 25, 1978; P.O. Box 1168, Santa Monica, Calif.

Dr. Edward Titus Miller, '49; April 19, 1979; 4674 Merwin, Houston, Texas

David B. Kret, '50; May 10, 1979; 2420 N. 73rd St., Scottsdale, Ariz.

Howard K. Smead, '51; April 7, 1979; 4704 Hibiscus Ave., Minneapolis, Minn

Dr. William S. Sheppard, '55; November 2, 1978; 408 Nichols Ave., McDaniel Crest, Wilmington, Del.

Arthur R. Klaeson, Jr., '58; May 8, 1979; 89 Prospect St., Seekonk, Mass.

Capt. Robert B. Sims, '59; February 23, 1977; 316 Burnside St., No. 407, Annapolis, Md.

Thomas W. Alexander, '60; May 23, 1979; 1552 Mitchell St., Tustin, Calif.

Donald B. Silverman, '60; April 3, 1979; 86 Blodgett Ave., Swampscott, Mass.

George W. Fraser, '63; March 12, 1979; 3 Sinclair Dr., Helensburgh, Scotland

Richard J. Olson, '63; February 12, 1979; 118 Monte Vista, Los Alamos, N.M.

Dr. John W. Hafstrom, '65; June 13, 1979; 15 N. Columbia St., Naperville, Ill.

Maj. Harry T. Doerer, '66; June 17, 1978; 15587 Cedar Hill Dr., Chesterfield, Mo.

James C. Sandusky, '67; December 11, 1978; 8186 Terrace, El Cerrito, Calif.

Kevin H. George, '71; April 26, 1979; P.O. Box 22232, Honolulu, Hi.

Thomas M. Demchock, '74; April, 1973

Frederic M. Sugarman, '74; May, 1973

Michael P. Chanette, '75; April 20, 1979; 12 High St., Granby, Mass.

Robert J. Crossan, '77; December 28, 1978; Rd. 2 Box 239, Landenberg, Penn.

Puzzle Corner



Allan Gottlieb is associate professor of mathematics and coordinator for computer mathematics at York College of the City University of New York; he studied mathematics at M.I.T. and Brandeis. Send problems, solutions, and comments to him at the Department of Mathematics, York College, Jamaica, N.Y., 11451.

100 Miles of Desert At 20 Miles a Day

Allan J. Gottlieb

As the volume number of Technology Review advances by one digit, here's a word of welcome back to all Puzzle Corner veterans and a warm greeting to those of you who I am meeting for the first time. For the benefit of the latter I would like to review the ground rules.

Each issue we publish five regular problems and two "speed" problems; three issues later the solutions to the regular problems appear. We also occasionally republish older problems to which solutions were never received. This month, for example, we are printing the solutions to problems published in the March/April, 1979, issue; and among the problems you will find an "NS" problem first published in May, 1977. Challenges to published solutions and acknowledgement of late responses appear in the "Better Late Than Never" department. The "speed" problems are not to be taken too seriously. Often whimsical, their solutions are usually given in the same issue as the problem is posed, and discussion of them rarely appears in the "Better Late Than Never" department.

Some interesting comments have been received from our veterans. First of all I want to send a great thank you to Judith Longyear. Dr. Longyear asked why the Review is using a circa 1967 photo of me. The truth is that the picture was taken two years ago expressly for "Puzzle Corner." If I appear younger than my years, perhaps it's because you have not seen the hundreds of shots we decided *not* to use.

Theodore Engle is still interested in factor champions and would like to correspond with Albert Mullin or anyone else interested in the subject. If you are interested in factor champions (e.g., smallest number with a million factors) please write to me for Mr. Engle's address.

Mary Lindenberg reports that she and her husband just returned from his 40th M.I.T. reunion where a classmate, upon seeing her name tag, asked if she was the Mary Lindenberg who contributes to "Puzzle Corner."

Finally, a personal note. Having completed my sixth year at York College, I am on sabbatical leave for 1979-80. I will be spending the year at the Courant Institute for the Mathematical Sciences in New York City. However, please continue to send all correspondence to me at the York College address given above.

Problems

NS 16 (nee **1977 MAY 4**) We begin this month with a past problem that was **Never** (completely) **Solved**. A palindrome is a

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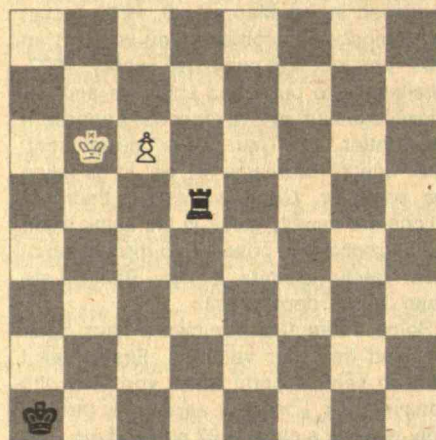
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number that reads the same left to right and right to left — e.g., 18781 or 372273. Take an arbitrary number and add it to its mirror image. If sum is not a palindrome add it to its mirror image. Keep going. Will a palindrome necessarily result? For example:

$79 + 97 = 176$;
 $176 + 671 = 847$;
 $847 + 748 = 1595$;
 $1595 + 5951 = 7546$;
 $7546 + 6457 = 14003$;
 $14003 + 30041 = 44044$;

So 79 does yield a palindrome. From what I gather 196 is a particularly interesting one to try. I have heard claims that 196 never yields a palindrome but have not seen a proof.

A/S 1 We begin this month's regular problems with a simple-looking chess problem from Steve Grant which contains a few surprises:



White to play and win.

A/S 2 Charlie Bahne needs your help to cross a 100-mile-wide desert. His expedition can travel 20 miles in a day. However, there are no supplies in the desert, and they can only carry two days' provisions at a time (today's plus one extra day's). They can, of course, go out into the desert, deposit a day's supplies, and return to their base. Supplies are sealed in one-day packages; they cannot be broken up. What is the least number of days it will take to cross the desert? You might also try two variants: Is there a general solution for deserts of different widths? Would the answer be different if the provision against fractional days' supplies were eliminated?

A/S 3 William Hornick sent us some examples of problems he and his wife call "the first five." They simply involve the listing of the first letter of the five words of a common, ordered series. For example, OTTF is One, Two, Three, Four, Five. That's an easy one. I offer you five more difficult First Fives; you have the aid of the clue that they all have to do with numbers.

1. U T H T T
2. F S T F F
3. S D T Q Q

4. O F N S T
5. O S T S O

A/S 4 Cyrus Bernstein has a question concerning surface-to-air missiles (SAMs): A SAM tracks its quarry through a heat sensor in the nose. Assume that there is a large square marked off in the sky. A plane enters the square at the southeast corner at 600 m.p.h. and proceeds on a straight course to the northwest corner. At the same moment that the plane enters the square, a SAM enters the southwest corner of the square going at 1200 m.p.h. Instead of "leading" the plane to intercept it more quickly, the SAM points at the plane at all times, thus traveling in an arc as it alters direction to follow the plane. The plane is following a diagonal line. How far up this diagonal line will the plane go before it is intercepted by the SAM?

Those of you who recall the hummingbird problem from a while ago should not have too much trouble with this one.

A/S 5 Emmet Duffy has a geometry problem for which he desires a non-calculus solution: Given an acute-angled triangle, find the inscribed triangle having minimal perimeter.

Speed Department

A/S SD 1 Greg Jackson wants you to punctuate the following sentence: Jack where John had had had had had had had had had had a more pleasant sound to it.

A/S SD 2 John Prussing wants to know how long it will take him to parlay \$100 into \$1 if he agrees to play a game of coin tossing in which he must bet half his current bankroll on each toss. If the coin comes up heads he wins, tails he loses. All winning bets are paid at fair odds 1:1. He begins with \$100 and must resign if his bankroll becomes less than \$1. During a certain game he won as many tosses as he lost but was forced to resign. After how many tosses did he resign? (Assume bets of arbitrary fractions of dollars are allowed).

Solutions

M/A 1 Evaluate this four-story gabled HOUSE on its GROUNDS so generous that there is both a front yard and a back yard.

U
O U S
H O U S E
H O U S E
H O U S E
H O U S E
G R O U N D S

Thomas Petterson, like nearly everyone else, assumed a decimal point is permitted. His solution was: HOUSE = 79804, GROUNDS = 329816.0. Here is how it works:

$S = 0$

Since D and N cannot be zero, E cannot be 0, 1, 2, or 3.

Similarly, since G and R cannot be 0, H cannot be 0 or 1.
Now, $6 * U = XU$, where X is some other digit, but U cannot equal zero. So

U = 2, X = 1; or
U = 4, X = 2; or
U = 6, X = 3; or
U = 8, X = 4.

And O is such that $5 * O + X = YO$ and O cannot equal U. Then if

U = 2, O cannot equal anything; or
U = 4, O can equal 2 or 7; or
U = 6, O cannot equal anything; or
U = 8, O can equal 4 or 9;
so OU = 24, 48, 74, or 98.

For each of these four possibilities, there are only a few possibilities for H and E. If OU = 24, then since $ND = 4 * E$ we have E = 0, 1, 2, 3, 4, 5, 6, 7, and 8; so E = 9. But then, since $GR = 4 * H + 1$ (when OU = 24), and $H = E$, $H = 0, 1, 2, 3, 4, 5, 6, 7, 8$, or 9; so H cannot equal any digit and OU cannot equal 24. By exhaustive search of the possible choices of H and E for the remaining three choices of OU (only 18 total), the unique solution is found: OU = 98, H = 7, and E = 4.

Also solved by Winslow Hartford, Harry Hazard, Richard Hess, Winthrop Leeds, Avi Ornstein, Frank Rubin, John Trifiletti, Harry Zaremba, and the proposer, the late R. Robinson Rowe.

M/A 2 South, on lead, to make the remaining six tricks with hearts as trump:

♠—
♥8 7
♦J 5
♣A 2

♠Q 7
♥—
♦Q 7
♣J 3

♠J 6
♥—
♦10 8 6
♣8

♠10 9
♥—
♦A K 9
♣10

Jerome Shipman had little trouble with this one:

The declarer has five top tricks: his ♦A and ♦K, and dummy's two trumps and ♣A. His problem is to promote an additional trick from among his ♠9, one of his two spades, and dummy's ♠2. He does this in the following way (assuming best play on the part of East and West): *Trick 1:* Declarer leads the ♦A, dropping dummy's jack under it, while West and East follow with the ♦7 and ♦6, respectively. *Trick 2:* Declarer leads the ♠10, trumping with the ♥8, while West and East follow with the ♠7 and ♠6, respectively. *Trick 3:* Dummy leads the ♥7, East discards the ♣8 and South the ♣10. West cannot discard a club, for then Dummy's ♠2 would be promoted to a winner; he cannot discard the ♦Q, for then declarer could finesse through East's ♦10. Therefore, West must discard the ♠Q. *Trick 4:* Dummy leads the ♣A. If East discards a diamond,

South discards the ♠9 and the ♦K and ♠9 (reached through Dummy's ♦5) are the fifth and sixth tricks. If East discards the ♠J, South discards the ♠9, and the ♦K and ♠9 are the fifth and sixth tricks.

Also solved by Edmund Chen, Jerry Grossman, Winslow Hartford, Richard Hess, Warren Himmelberger, George Holderness, Paul Horvitz, Thomas Mouthner, Scott Nason, John Rutherford, Stuart Schulman, John Trifiletti, Donald Trumpler, Shirley Wilson, and the proposer, Noland Poffenberger.

M/A 3 Eleven open bags, numbered 1 to 11, each contain two coins. Ten bags contain genuine coins all of the same weight. One bag contains false coins which differ slightly in weight from genuine coins. The two false coins weigh the same but a false coin is either 10 grains heavier or 10 grains lighter than a genuine coin. You are given a balance scale and 20-grain weight. Using the balance scale two times only, find a method to identify the false coins and tell whether they are heavy or light. Placing stated coins on stated sides of the scale, and, if required, placing the weight on the scale, shall be considered a use of the scale.

This one is a little subtle. The key is that adding the 20-grain weight does not count as a new weighing. The following solution is from Dean Lytle:

Place the coins as shown below, with coins from bags 10 and 11 held out:

1 1 2 2 3 3 9 4 4 5 5 6 7 8

If the scale balances, the false coins are in bag 10 or 11, and we proceed as follows:

10 10 11 G G G

The left hand side will be either heavy or light. Suppose it is heavy. Place the 20-grain weight on the right side. If the scales balance, coins from bag 10 are counterfeit-heavy. If the scales are heavy on the right, bag 11 is counterfeit-heavy. The same procedure applies if the left side is light, except the weight is put on the left side. If the first weighing does not balance, we proceed as follows:

□ Place the weight on the right (light) side. If balance is achieved, bags 1, 2, or 3 are heavy or bags 4 or 5 are light; go to the second step (below). If the right side becomes heavy, bag 9 is heavy or bag 6 or 7 is light; go to the third step (below).

□ Place the coins as follows, G denoting coins from bags 6 through 11.

1 1 2 4 4 5 G G G G G G

If the left side is doubly heavy — i.e., it balances with the 20-grain weight added on the right), 1 = H. If the left is singly heavy, 2 = H. If the right side is doubly heavy, 4 = L. If the right side is singly heavy, 5 = L. If the two sides balance, 3 = H.

□ Place the coins as follows:

8 8 G 6 6 7

If the left side is doubly heavy, 6 = L. If the left side is singly heavy, 7 = L. If the right side is doubly heavy, 8 = L. If the two sides balance, 9 = H.

Also solved by Edward Gaillard, Raymond Gaillard, Michael Haney, Richard Hess, Winthrop Leeds, Maurie Libner, Scott Nason, Thomas Peterson, Frank Rubin, John Trifiletti, and the proposer, Emmet Duffy.

M/A 4 Find a collection of (ordinary) English words that contains the fewest possible total number of letters while including each of the 26 letters at least once.

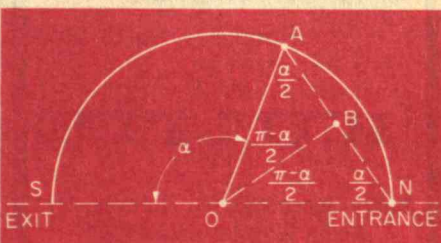
Surprisingly, Frank Rubin and Winthrop Leeds found essentially the same solution; the only difference between them was to place the s at the end of a different noun. Their solution, with only 27 letters, is: BAWD FLOCKS JIG NYMPH QUARTZ VEX.

Also solved by Edward Gaillard, Raymond Gaillard, Steve Feldman, Winslow Hartford, Richard Hess, Terence Langendron, Stuart Schulman, William Stein, Ernest Thiele, John Trifiletti, Shirley Wilson, and the proposer, Hugh Thompson.

M/A 5 A unicyclist moving at velocity v enters the north end of a table rotating at an angular velocity w. He wishes to leave via an exit ramp at the south end of the table in the minimum possible time, t. Find t and the path required as a function of v, w, and r (the radius of the table).

Apparently it is not possible to give an explicit formula for T. Emmet Duffy submitted the following derivation of an implicit formula:

Let T = time in seconds to make the trip; let w = the angular velocity of the table in radians, R = the radius in feet, v = the velocity of cyclist in feet per second, and t = variable time in seconds. The cyclist should move in a straight line (on the table) to some point A on the periphery of the table so that his time of travel to point A is the same as the time it takes point A to travel to the exit.



The cyclist's path will be NA. Draw the per-

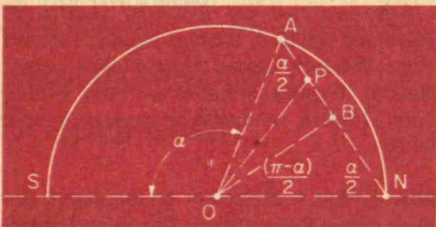
pendicular bisector OB of path NA. Let angle AOS = α . Then angle AON = $\pi - \alpha$. As OA = ON = R, then angles OAN and ONA are equal and are $\alpha/2$. Path NA then is equal to $2R \cos \alpha/2$. Then

$$(2R \cos \alpha/2)/v = \alpha/w.$$

Since $T = \alpha/w$, we get

$$T = 2R/v \cos(\alpha/2).$$

For given values of R, v, and w, an approximate value of T can be obtained by standard methods. The curve of motion is easily found as a ρ, θ curve with the x-axis passing through N (entrance) and S (exit), with the origin O at the center of the table.



Let t be the parameter in seconds. Then

OP = ρ , where P is a point on the curve.

Angle PON + $wt = \theta$. PN = vt . BN = $R \cos(\alpha/2)$. Then:

PB = $vt - R \cos(\alpha/2)$, as

OB = $R \sin(\alpha/2)$ and

OP = $[(PB)^2 + (OB)^2]^{1/2} = \rho$. Then

$\rho = ([vt - R \cos(\alpha/2)]^2 + [R \sin(\alpha/2)]^2)^{1/2}$

$\theta = \text{Angle PON} + wt = \text{Angle POB}$

+ Angle BON + wt . Therefore,

$$\theta = \arctan([vt - R \cos(\alpha/2)]/R \sin(\alpha/2)) + (\pi - \alpha)/2 + wt.$$

We do have a small controversy, however. The proposer, S. Baranow, claims (without a complete derivation) that

$$t = [2 \tan^{-1}(Rw/v)]/w.$$

Since this explicit formula is incompatible with Mr. Duffy's implicit solution, we may hear more about this problem later.

Also solved by Winslow Hartford, Richard Hess, Gary Lewison, Dave Mohr, Frank Rubin, F. Steigman, and Harry Zaremba.

Better Late Than Never

NS 13 Although we still have not received an exact answer, two interesting replies were received. Frederic Vose found several trigonometric relations which give him a new approximation method and Felix Alexa submitted a beautifully done 1×2 foot drawing.

1978 M/A 5 Apparently we have trouble getting parenthesis correct. Irving Hopkins notes that

$$\cos(18^\circ) = [(5 + \sqrt{5})/8]^{1/2}$$

J/J 1 Mark "the shark" Aquino has an alternate method of playing the hand which gives a 97.2 per cent probability of success.

D/J 3 Several readers were unhappy with the published solution. Since Dr. Rubin, the proposer, had previously written to say that

the problem itself was incorrectly printed, I have asked him to send me another copy of the problem so that we can try again. Responses have been received from Jonathan Hardis, Greg Hunter, Thomas Mahon, Ron Moore, and James Voss.

Y1978 Harry Hazard notes that

$$3 = 1 - [(9 + 7)/8]$$

$$89 = 1 * (97 - 8)$$

1979 FEB 2 Allen Keith, Hugh Thompson, and Gary Lewison have responded.

FEB 3 Gary Lewison, William Stein, and Harry Hazard have responded.

M/A SD 1 Theodore Edison and Joseph Friedman note that the area is 144 square inches and that the formula is $(R^2 - 4^2)$.

Proposers' Solutions to Speed Problems

A/S SD 1 Jack, where John had had "had had," had had "had"; "had had" had a more pleasant sound to it.

A/S SD 2 If the number of wins and losses are equal, the number of tosses must be even and the order of the wins and losses is immaterial. Assuming an initial bankroll B_0 , after $2n$ tosses the bankroll is

$$B_{2n} = (3/4)^n B_0.$$

The smallest value of n for which $(3/4)^n$ is less than 0.01 is 17. Thus, he resigned after 34 tosses.

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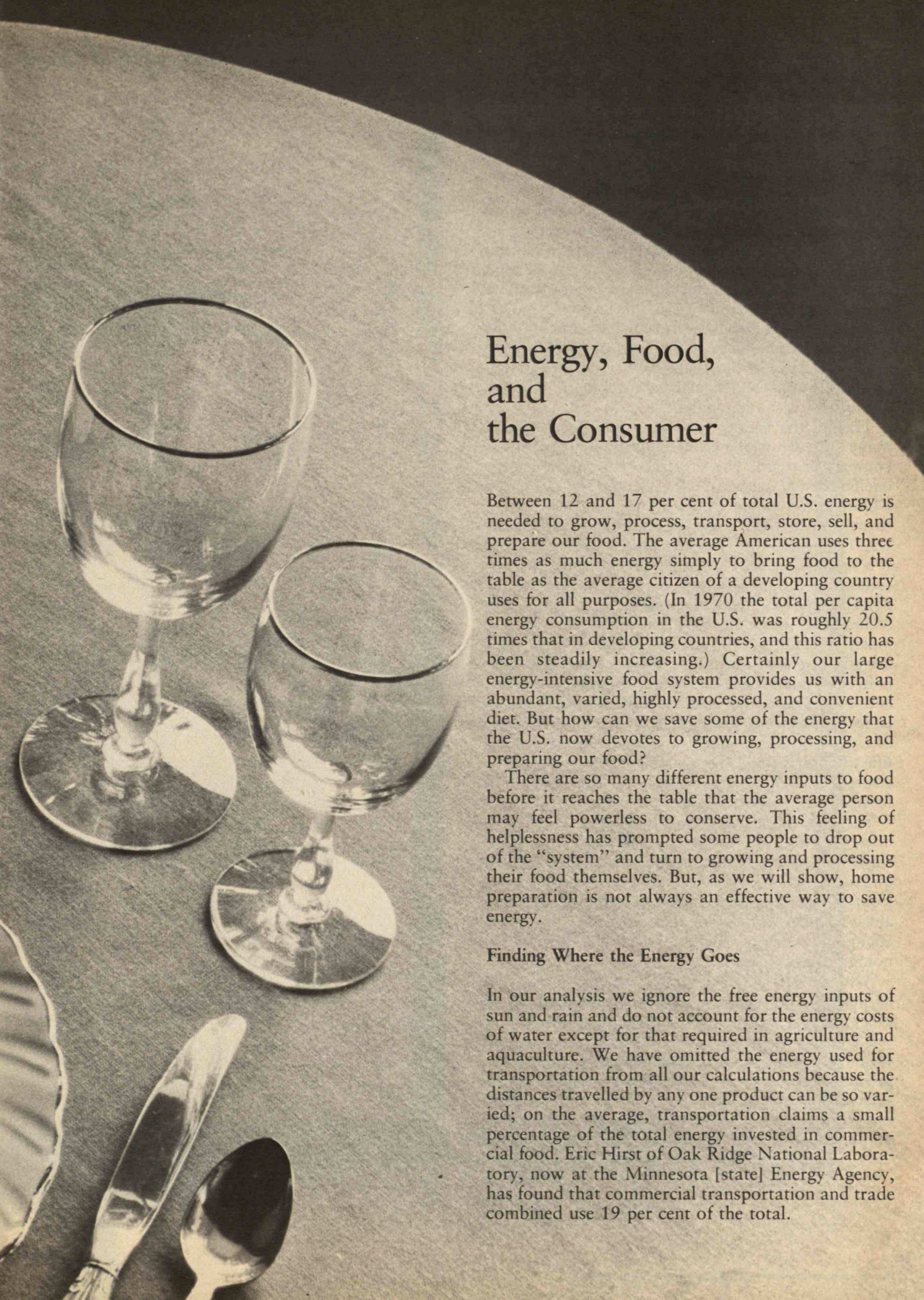


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Energy, Food, and the Consumer

Between 12 and 17 per cent of total U.S. energy is needed to grow, process, transport, store, sell, and prepare our food. The average American uses three times as much energy simply to bring food to the table as the average citizen of a developing country uses for all purposes. (In 1970 the total per capita energy consumption in the U.S. was roughly 20.5 times that in developing countries, and this ratio has been steadily increasing.) Certainly our large energy-intensive food system provides us with an abundant, varied, highly processed, and convenient diet. But how can we save some of the energy that the U.S. now devotes to growing, processing, and preparing our food?

There are so many different energy inputs to food before it reaches the table that the average person may feel powerless to conserve. This feeling of helplessness has prompted some people to drop out of the "system" and turn to growing and processing their food themselves. But, as we will show, home preparation is not always an effective way to save energy.

Finding Where the Energy Goes

In our analysis we ignore the free energy inputs of sun and rain and do not account for the energy costs of water except for that required in agriculture and aquaculture. We have omitted the energy used for transportation from all our calculations because the distances travelled by any one product can be so varied; on the average, transportation claims a small percentage of the total energy invested in commercial food. Eric Hirst of Oak Ridge National Laboratory, now at the Minnesota [state] Energy Agency, has found that commercial transportation and trade combined use 19 per cent of the total.

The energy required to produce food can be divided into three categories according to use:

- Energy to run tractors, trucks, and other vehicles and to produce electricity needed to power food processing machinery, including refrigerators and home appliances.
- Energy embodied in — needed to make — the materials used in each of the food production processes: fertilizer, fishing nets, packaging, and so on.
- Energy used to make needed machinery, vehicles, and other capital equipment.

Tracing the energy used in making each of the many ingredients of a processed food is an extremely complex exercise. The shortcut of using the energy coefficients developed at the Center for Advanced Computation at the University of Illinois (from information in the *Census of Manufacturers* of the U.S. Department of Commerce) is tempting because it is so convenient. These coefficients relate the consumer's or retailer's dollar cost for a product to the British thermal units of total energy used to make it, including that consumed by machinery, embodied in materials, and used to acquire raw materials. They are given in units of B.t.u.s per dollar and are available for numerous "standard industrial classifications." The dollar cost must be adjusted to account for inflation, product lifetime, and, in the case of capital equipment, the amount of product manufactured or handled. For such analysis electricity is converted to "primary energy" — the amount of fossil fuel needed to produce each kilowatt hour.

The usefulness of these coefficients is limited, however, because the many standard industrial classifications are broad and the energy input required to make a specific food product may differ from the average of its class. In addition, they are always somewhat out of date and may not show changes in energy efficiency resulting from technological advances.

A more satisfactory, if painstaking, analysis can be achieved by detailed study of energy inputs at every stage of making and distributing a product. In this analysis of energy consumption related to food we have combined two methods, using process-by-process analysis for everything except capital inputs such as machinery, appliances, ships and vehicles, for which we have relied on the broader input-output data from the University of Illinois.

Seafoods

| | Energy input (kcal. per gram of fish protein) | |
|-------------------------------|---|-------------------------|
| <i>Maine herring:</i> | | <i>Halibut:</i> |
| Harvesting | 6.58 | Harvesting |
| Processed canned sardines | 63.6 | Processed frozen steak |
| Wholesale | 0 | Wholesale refrigeration |
| Retail | 0 | Retail refrigeration |
| Home storage | 0 | Home refrigeration |
| Home preparation: | | Home preparation: |
| Sardine sandwich | 0 | Baked with sauce |
| | | Poached |
| <i>Pink salmon:</i> | | <i>Haddock:</i> |
| Harvesting | 30.4 | Harvesting |
| Processed canned | 62.5 | Processed fresh fillet |
| Wholesale | 0 | Wholesale refrigeration |
| Retail | 0 | Retail refrigeration |
| Home storage | 0 | Home refrigeration |
| Home preparation: | | Home preparation: |
| Salmon burgers (top of stove) | 17 | Poached |
| Salmon salad | 0 | Chowder |
| Soufflé | 77 | |
| <i>Flounder:</i> | | <i>King Salmon:</i> |
| Harvesting | 95.2 | Harvesting |
| Processed fresh fillet | 26.8 | Processed fresh steak |
| Wholesale refrigeration | • | Wholesale refrigeration |
| Retail refrigeration | 1 | Retail refrigeration |
| Home refrigeration | 4 | Home refrigeration |
| Home preparation: | | Home preparation: |
| Soufflé | 83 | Baked |
| Poached | 13 | Poached |
| | | <i>Lobster</i> |
| | | Harvesting |
| | | Processing (live) |
| | | Wholesale refrigeration |
| | | Retail storage |
| | | Home refrigeration |
| | | Home preparation: |
| | | Boiled |
| | | Baked stuffed |

Menu of Energy Inputs

Energy input
(kcal. per gram
of fish protein)

93.2
37.8
.
1
4-26
42-44
12-14

Tuna

Harvesting
Processed canned tuna
Wholesale
Retail
Home storage
Home preparation:
Creamed tuna
Tuna sandwich or salad

Energy input
(kcal. per gram
of fish protein)

81.3
88.7
0
0
0
1
0

Scallops

Processed (frozen)
Wholesale refrigeration
Retail refrigeration
Home refrigeration
Home preparation:
Baked
Sautéed

326
3
1
3-21
37-56
17-26

Shrimp:

Harvesting
Processed fresh
Wholesale refrigeration
Retail refrigeration
Home refrigeration
Home preparation:
Sautéed
Salad

598
144
.
1
4
14
14

Blue Crab:

Harvesting
Processed fresh steamed
Wholesale refrigeration
Retail refrigeration
Home refrigeration
Home preparation:
Baked
Crab cakes
Crab salad

27.5
771
.
1
4
36
16
0

Meats and Poultry

Energy input
(kcal. per gram
of protein)

Feed-lot beef:

Agriculture
Processed meat
Wholesale refrigeration
Retail refrigeration
Home refrigeration
Home preparation:
Grilled lean hamburgers
Rump roast (choice grade)

800
16
.
.
8
26
16

Chicken (broiler):

Agriculture
Processed poultry
Wholesale refrigeration
Retail refrigeration
Home refrigeration
Home preparation:
Roasted

149
8
.
.
4
69

*Asterisk indicates that the energy increment is too small to make a change, within the accuracy of these numbers.

Conservation in the Kitchen

At what points can consumers affect the amount of energy invested in the food they buy? For most foods the dollar cost of home preparation is a small fraction of the purchase price, giving the intuitive — but erroneous — impression that the energy cost is also small. But on the average, 30 per cent of the total energy used to produce food, starting from agriculture or fishing, is consumed in the home. And this 30 per cent is only part of the energy a consumer can control.

The National Bureau of Standards is currently studying the energy used at home for cooking. (Research includes such details as the effect of the shape and material of utensils, types of lids, and so on.) In this program the bureau recently ran a test kitchen in which five cooks prepared the same meals for seven days. Their energy consumption varied by as much as 50 per cent, mainly due to differences in oven use. It appears that a cook's efficiency can be more important than an oven's!

Some other interesting relationships:

- Baking for an hour in a conventional electric oven at 350°F uses 4,210 kilocalories of energy; simmering for the same time on an eight-inch stove-top burner uses only 520 kilocalories.

- A self-cleaning oven requires less energy than a conventional oven to maintain a given temperature because of better insulation, but the total energy used depends on the frequency of cleaning.

- Baking in a microwave oven uses approximately 40 per cent less energy than a conventional electric oven but 30 per cent more energy on the average than top-of-the-stove cooking.

In our calculations baking energies are all near-minimum values. We assume that food was put in the oven after a 10-minute warmup, the oven door was opened only once, and the oven was turned off as soon as the food was cooked. In actual practice energy use may be much higher.

A pressure cooker provides another means of saving energy in the kitchen and provides the additional benefit of fast cooking time — around one-third of the time needed for conventional cooking of stews and pasta.

Buying frozen food in large volumes may save dollar cost but is not an energy-efficient practice. To store food in a home freezer for 30 days requires 2,220 kilocalories per pound; huge wholesale freezers require only a little more than 50 kilocalories per pound.

Decision Point: Supermarket

Different foods require vastly different amounts of energy to bring them to the point of retail purchase, and the educated consumer can buy nutritionally comparable foods that have widely varied energy inputs. Purchasing foods on the basis of their energy inputs while maintaining constant nutritional output is much more complicated than it may seem — and far more demanding intellectually than conserving energy in home storage or preparation. Such purchase judgments require the detailed understanding of how energy is used in the growing, processing, and storing of foods, and of how to make the calculations for different products in a comparable manner — a large order.

Although much is known about agricultural energy use, food processors have only recently started to think of costs in terms of energy. Companies with many products are finding it difficult to calculate energy use for individual food products, and they often consider such information confidential when it is known. To add to the problem, there are only rough estimates of the energy used by consumers in home preparation and of transportation patterns for grocery shopping. Nevertheless, we can construct various scenarios with selected foods and show the energy differences among them. Some of these scenarios are reviewed in the following paragraphs.

Protein Sources Contrasted

The energy needed to produce a gram of protein varies greatly from one source to another. For example, farm animals may have refuse and forage in their diet, but most also eat grains grown especially for them. The energy used to provide that feed must be included with that needed for the rest of their care. Range-fed cattle use less fertile land (and grow more slowly) and produce less saturated fat than feed-lot cattle. But, partly because “cowboys” now use jeeps and airplanes rather than horses, range-fed animals represent an investment of approximately the same energy per pound of meat produced as their feed-lot counterparts.

Overall, meat is one of our most energy-consumptive foods. The high energy use is not due to processing, as fresh meat packaging require little energy and meat spends but a short time in refrigerated storage. The culprit is the large energy use on the farm and feed-lot, making the beef industry

Fruits and Vegetables

| | Days in home refrigerator | Energy per I.U. of Vitamin A | Energy inputs per milligram of Vitamin C |
|------------|---------------------------|------------------------------|--|
| Apples | 0 | 2.3 | 53 |
| | 4 | 5.4 | 130 |
| | 14 | 13 | 320 |
| Asparagus | 2 | 0.96 | 26 |
| Grapefruit | 4 | 10 | 22 |
| Grapes | 2 | 4.5 | 130 |
| Lemons | 4 | 42 | 13 |
| Lettuce | 2 | 0.67 | 34 |
| Onions | 0 | 2.6 | 10 |
| Oranges | 4 | 3.3 | 13 |
| Peaches | 2 | 0.29 | 52 |
| Plums | 2 | 1.0 | 45 |
| Tomatoes | 2 | 0.37 | 15 |

one of the most extravagant users of energy.

It is clear that more energy is needed to produce a gram of animal protein than a gram of protein from grains or legumes that are eaten directly — but there are variations in agricultural energy requirements, and vegetable sources generally have less protein by weight than meat.

The energy required to catch a gram of seafood protein depends mainly on the amount of time a boat spends in filling its hold. A captain is probably willing to spend much more effort looking for the higher-priced species, and thus there is almost as great a difference in the energy used to harvest different types of seafoods as between animal and vegetable proteins. The energy to catch the fish is not the only energy involved, however, so we must see whether some of these energy differences level out after the catch.

Processing fish for freezing and for direct consumption requires nearly the same energy, but canning takes more — partly because the metal packaging is energy-intensive. R. Stephen Berry and Hiro Makino at the University of Chicago have calculated that acquiring the constituent materials and forming a steel can that holds one pound of food consumes 1,000 kilocalories of energy. A paper package con-

taining a pound of frozen food, depending on its size, requires only 300 to 680 kilocalories.

Frozen food must be refrigerated, and 90 days in a wholesale freezer and 15 days in a retail frozen-food department add 220 kilocalories per pound. Frozen food must also have refrigerated transport; but assuming the food goes by truck, refrigeration makes a negligible addition to the energy used for the transportation itself.

The energy used in home preparation can vary widely. For instance, canned salmon can be eaten directly from the can in a salad using no additional processing energy, cooked on top of the stove adding around 400 kilocalories per pound, or baked in a soufflé, adding roughly 5,000 kilocalories per pound. Thus, the cook can, by making a salad rather than a soufflé, save almost as much energy — 6,270 kilocalories per pound — as is needed to catch, can, and bring to the table the herring for sardine sandwiches! On the other hand, the cook making the soufflé can be consoled with the thought that the extra energy used to make it was less than that needed just to catch nutritionally equivalent protein from king salmon, lobster, or shrimp. Clearly, choices by consumers in both the manner of preparation and the type of food prepared make major

Nutritional Yield of Foods Compared With Energy Consumed In Their Production

| Food | Ratio of input energy (kcal.) to nutritional output (kcal.) | | |
|----------------------------|--|--------------------------------------|------|
| Boiled lobster | 160 | Fresh peaches | 10.1 |
| Broiled lean hamburger | 120 | Fresh apples | 8.5 |
| Rump roast | 110 | Cape Cod oysters on the halfshell | 8.5 |
| Poached cod fillet | 27 | Canned sardines | 8.3 |
| Poached king salmon | 19 | Canned peaches in syrup | 7.4 |
| Frozen sautéed fish sticks | 12 | Fresh grapes | 6.7 |
| Frozen peaches | 12 | Bakery bread | 1.3 |
| Fresh oranges | 13.3 | | |
| Canned pineapple in water | 9.2 | | |

changes in the total energy input; and equally clearly, the trade-offs and alternatives are too complex for most supermarket shoppers to analyze.

Sugar is Not a Cheap Source of Calories

In *Dietary Goals for the United States*, the Senate Select Committee on Nutrition and Human Needs recommends that we reduce consumption of refined sugar. Sugar provides "empty calories" that are devoid of all other nutrients, promotes tooth decay, contributes to obesity, and is associated with the development of diabetes. The growing of sugar requires little energy, so refined sugar is often referred to as a cheap source of calories; but this characterization does not include the energy needed for processing. According to the *Census of Manufacturers'* standard industrial classifications for "food and kindred products," the processing of sugar beets and the refining of cane sugar, along with the milling of wet corn and the processing of malt beverages — all sources of "empty" calories — take 20 per cent of the total energy used to process food in the U.S. The production of one pound of refined beet sugar requires 4,360 kilocalories, cane sugar, 2,610 kilocalories; and each gives back only 1,746 empty

nutritional kilocalories. Interestingly, in Brazil it has been found that less energy is needed to ferment and distill sugar into alcohol than to refine it.

What could be substituted for these energy-intensive, nutritionally undesirable foods? The Senate Select Committee has recommended increased consumption of grains, legumes, and fresh fruits and vegetables.

Bread

Grains enter our diet in many ways, one of the most familiar of which is flour. A pound of white wheat flour for bread, including the energy embodied in and needed to run agricultural machinery, represents an investment of 1,740 kilocalories and provides fully 1,656 kilocalories nutritionally — along with vitamins, minerals, and 53.5 grams of protein. It takes 1,590 kilocalories to produce a one-pound loaf of bakery bread (which, of course, uses less than one pound of flour, accounting for the difference in energy input needed to produce that much flour).

Overall, home baking is surprisingly energy-intensive. Even if six loaves are baked at once, more energy is used in home baking — 2,330 kilocalories per pound — than at the commercial bakery, which

as we stated earlier uses only 1,590 kilocalories per pound. If only two loaves are baked at once, the home cook consumes twice as much energy per pound of bread as the commercial baker. In addition the commercial baker uses 50 kilocalories less per loaf because of the bulk packaging materials.

These comparisons do not include the energy cost of transporting commercially-baked bread to its consumer. A special automobile trip just to buy a loaf of bread could raise the energy cost of bakery bread astronomically. (One could bicycle or walk, of course, and avoid such waste.)

Fruits and Vegetables

The Senate Select Committee has recommended that we consume more fresh fruits and vegetables, and variety in this essential dietary area is important both nutritionally and psychologically. Though there are significant differences in the amount of energy invested in various fruits and vegetables to produce equal amounts of the various vitamins and minerals, we conclude that energy conservation can be better accomplished in ways other than changing patterns of fruit and vegetable consumption. Overall, it is clear that fresh fruits and vegetables require much less energy to be brought to the table than do their canned or frozen counterparts.

Convenience Foods

The desire of many consumers to spend less time in the kitchen has made prepared, "convenience" foods the most rapidly growing part of the food processing industry. As a class, frozen specialties such as pizzas, cakes, pies, and TV dinners take three times as much energy to process as do plain frozen fruits and vegetables. However, as we have seen, using commercially baked goods such as bread (and some pies) may be more energy-efficient than cooking them from scratch at home.

We have analyzed only a few frozen specialties: codfish cakes, fish sticks, sole in lemon butter, and fish with chips — these are frozen raw and must be cooked at home. The processor of fish with chips and codfish cakes uses energy-intensive automated machinery, and these processed foods have an energy cost of 3,600 to 4,100 kilocalories per pound more than their home-prepared counterparts. In contrast, the processor of canned codfish cakes and frozen fish sticks is able to incur less fish waste than would the home cook working from scratch, so his

total energy use is less.

Use of aluminum trays with frozen foods increases their energy input by about 1,500 kilocalories per pound. The retail paper packaging for these convenience foods (which are sold in portions smaller than one pound, and therefore use more than one package per pound) adds 300 to 750 kilocalories per pound over home-prepared. In sum, convenience food products whose preparation requires large-scale equipment and whose distribution requires metal packaging are energy-intensive. On the other hand, a commercial processor often uses raw food supplies much more efficiently than can the individual consumer; for example, a processor can use vegetables of a size or shape undesirable or unavailable to the consumer. The energy savings from this salvage of otherwise wasted food is most significant for the higher-energy livestock and fish proteins. (One might argue that if the food had not been used for humans, it could have been used for animal feed, but considering the poor efficiency of livestock and fish in converting feed to meat, this is a wasteful use of food that could be eaten directly.)

Recipe for Food Energy Savings

The educated consumer can make significant savings in the energy used in the food system, particularly through the choice of protein foods. The National Research Council recommends that the average adult man and woman consume 56 and 46 grams of protein per day, respectively. Actually, the average American eats about 103 grams per day, of which 60 grams comes from animals and fish. But only 20 grams from these sources is considered necessary for the average adult (children and infants need more). One energy-saving strategy is thus obvious: substitute some vegetable protein for meat. Since red meat is high in saturated fat, the substitution would promote cardiovascular health as well as save energy.

Fish are another substitution possibility. Some fish require very little in the way of energy to reach the table. Fish generally are low in saturated fat and high in the most desirable polyunsaturated fatty acids, making them even more attractive.

Substitution of grains and fish for some red meat or energy-intensive seafoods need not radically change the diet. Perhaps one would eat a sardine sandwich for lunch instead of shrimp or a hamburger; perhaps pasta for dinner instead of roast or lobster. Some specific examples:

□ If the nation's population of 220 million were to



substitute a pound of perch or sardines for a pound of beef or shrimp once a month for one year, the energy saving would be equivalent to 144 to 177 trillion kilocalories or 99 to 117 million barrels of oil.

□ Substitution of a pound of bread for a pound of beef monthly throughout the year would save energy equal to that contained in 121 million barrels of oil.

□ If the population would eliminate one hour's baking at 350°F with a conventional electric oven once a month, the saving would be equivalent to 7.6 million barrels of oil.

□ If we each refrained from using a throw-away aluminum tray once a month, the equivalent of 2.8 million barrels of oil would be saved.

□ If we were to substitute wheat flour as a source for only half of the 36.9 trillion nutritional kilocalories we now derive from sucrose, the annual saving would be equal to the energy in 12.9 million barrels of oil — and we would each still have 79 pounds of caloric sweeteners, including 48 pounds of sucrose.

Will average citizens be willing to make these changes? We don't know. First they must be informed.

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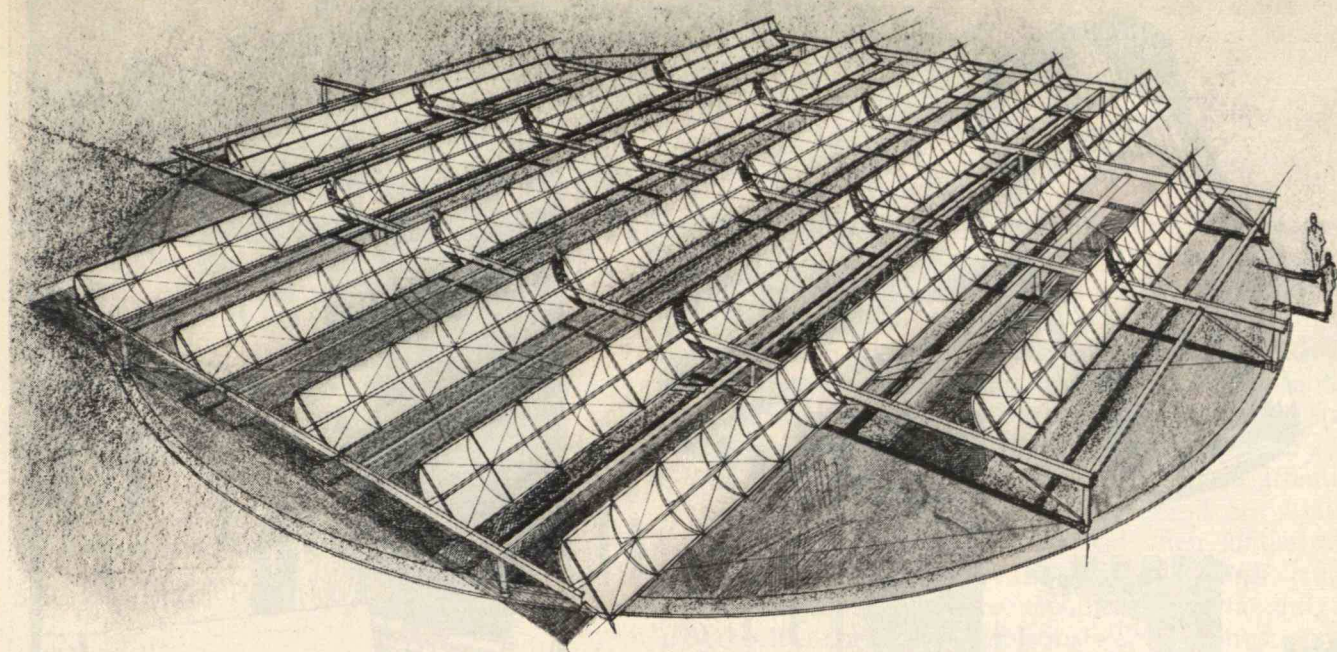
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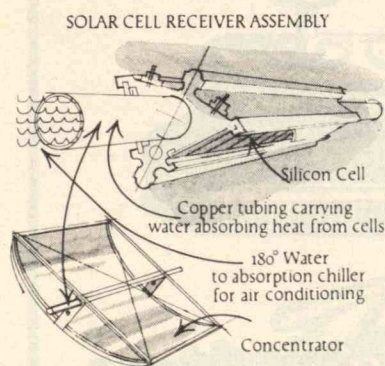
The work reported in this article was supported by grants from Monsanto Co. and the U.S. Department of Energy.



8 years ago, we designed turntables to track records. Today, we're designing turntables to track the sun.

What you're looking at is a turntable that measures 146 feet in diameter — a turntable programmed by computer to track the sun's azimuth while concentrators track the sun's elevation. Nine of these turntables are being designed to power marine-mammal life-support systems at Sea World in Florida.

The photovoltaic concentrator system uses high-intensity silicon solar cells to convert sunlight



into electric power and is under study by General Electric for the U.S. Department of Energy. Parabolic troughs on each turntable are formed of aluminum sheets covered by a reflective film laminate. They are angled to concentrate energy

on a focal line of solar cells. DC power generated by the photovoltaic cells will be converted to AC power providing up to 300 kw of peak electricity—enough power to service about 40 average homes.

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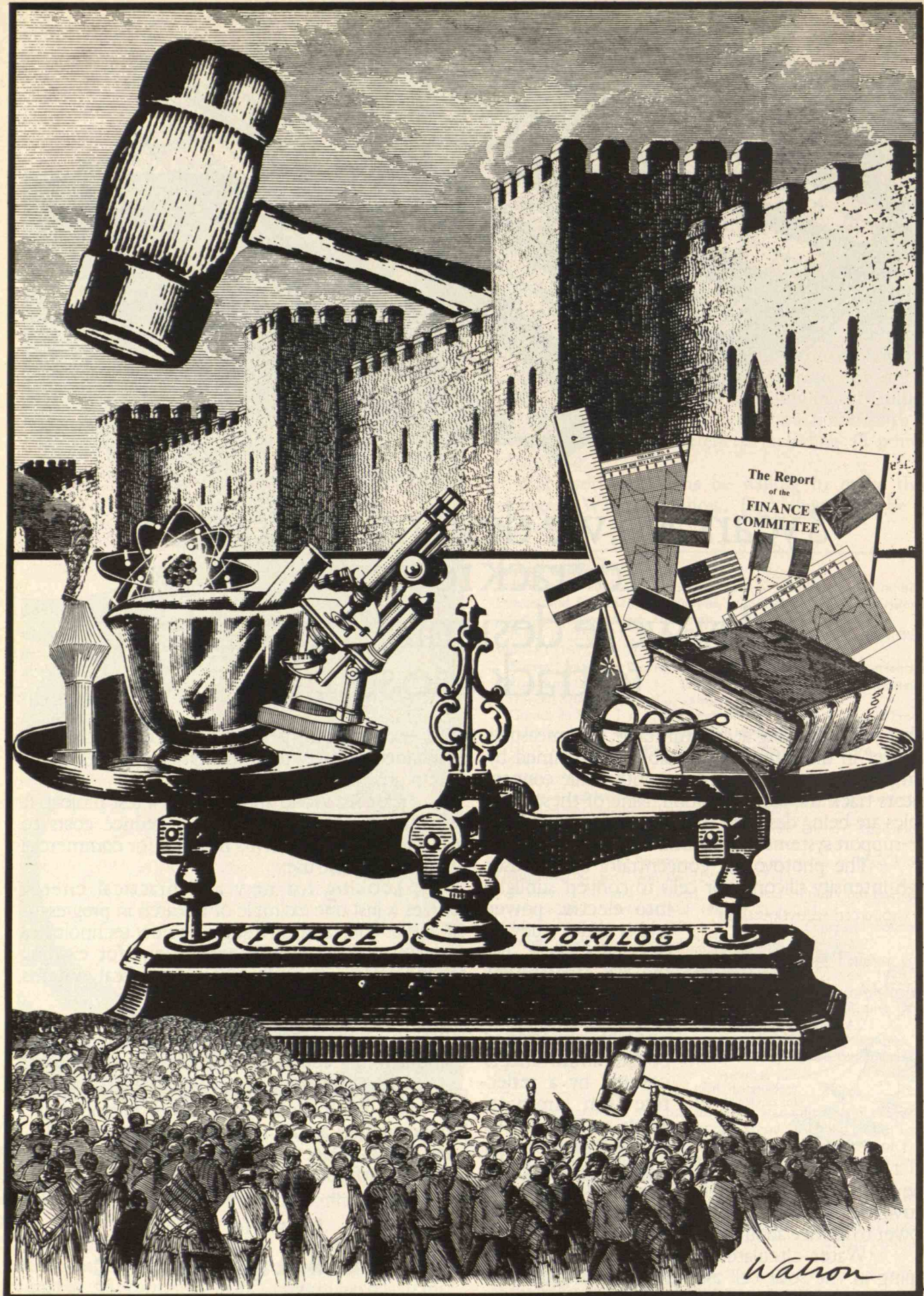
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Public Participation in Technological Decisions: Reality or Grand Illusion?

by Dorothy Nelkin
and Michael Pollak

In the United States and Western Europe, public inquiries have been shaped by national political style, expectations about the role of government, and local participatory mechanisms. But most have been structured discussions, over predetermined policy, with few real options.

"Demystification," "accountability," "citizen participation." These are the slogans of recent disputes in the U.S. and Western Europe through which citizens' groups have sought a voice in technological decisionmaking. Involving the location and design of nuclear power plants, the siting of airports and industries, or the establishment of rules and standards to protect public safety and the physical environment, these disputes have called public attention to the risks of new technologies and our limited ability to predict and control their undesirable side-effects. Moreover, the disputes have challenged the legitimacy of the technical experts and authorities heretofore responsible — almost exclusively — for decisions that are technologically *based* but which have dramatic social impacts.

Awareness of the decline in public trust has stimulated a great variety of governmental efforts to involve citizens more directly in creating and implementing policies on technology. Procedures have ranged from broadly participative inquiries to environmental mediation. They have included complaint and consultation systems, commissions and councils — some intended to advise decision-makers, others to inform the public. They have varied radically in their definition of public participation and in their relative weighting of technical and political information in decision-making.

But most such participatory "reforms" have been based on the assumption that they will lead to the acceptance of controversial technologies and to the restoration of the legitimacy of decision-making institutions. The procedures considered appropriate depend on national political styles and on the perceived nature of the problem of public acceptability. If lack of confidence is thought to be a problem arising from insufficient technical evidence, then the goal is to ascertain "scientific truth." This leads to a structure based on scientific advice to public representatives. If the controversy is defined in terms of alienation, a more participatory or consultative system is developed. And if the problem of public consensus is defined in terms of inadequate information, it is assumed that people oppose technologies because they are poorly informed. The task then becomes one of "education."

These three definitions of the problem of public acceptability have evolved three distinct "models" for its resolution: "advisory" (see table on page 61), "public consultation" (page 57), and "information" (page 59).

Advisory Models

Among the more well-publicized and controversial proposals to resolve technological disputes in the United States is the "Science Court," a quasi-judicial procedure in which scientists with different views (on issues such as nuclear safety or the effect of high-voltage transmission lines) would argue before "impartial scientific judges." In this proposed forum, debate would be limited to questions of fact: judges are to give opinions only on factual matters, leaving social value questions for the political arena. But the opinion of the Science Court is expected to have enough authority to provide a basis for policy decisions. Democratic control of technology follows from establishing "the truth" among conflicting claims of scientists, claim Science Court proponents.

This concept has seeded a crop of similar proposals for a "technical review board," a "technological magistrature" and a new profession of "certified public scientists." All these proposed institutions would provide neutral judgments to help settle disputes. They assume that scientists, through adversary procedures, can reach agreement on specific questions of risk and that this will lead to public consensus.

Similar assumptions motivated an experimental "energy campaign" in Austria, where the government set up structured public debates among scientists with opposing positions on the government's nuclear policy. The purpose, however, was not to achieve consensus but rather to highlight the controversial dimensions of the nuclear program and to clarify areas of persistent disagreement. This would then serve as a basis for parliamentary decisions, or so it was hoped. But instead of reassuring the public and reducing conflict, the debate among scientists contributed to the public skepticism that eventually killed the entire Austrian nuclear program altogether.

Other efforts to establish consensus through advice from key sectors have involved public officials and the leaders of major associations. In France, for example, a system of "regional concertation" was organized to facilitate industrial siting decisions, but this approach had certain limitations, as the following case illustrates. In 1976, *Electricité de France* (E.D.F.) — the government-owned utility — circulated dossiers providing technical data on 34 potential nuclear sites to French regional assemblies. The assemblies were to examine the dossiers and reach an informed agreement about the acceptability

of the sites. But with inadequate technical advice these assemblies were unable to deal with the substance of the dossiers and were easily manipulated by local political forces.

In the German political context, consensus on controversial projects is sought by including leaders of key institutions on advisory committees. In 1975, for example, the Ministry of Science and Technology employed 927 consultant experts from research organizations, industry, unions, and other interest groups. But 80 per cent of these experts represented scientific and industrial interests, suggesting that harmony among these elite interests remains the crucial component of political consensus. Here too, the relatively closed system of decision-making has tended to increase conflict and to encourage further political protest.

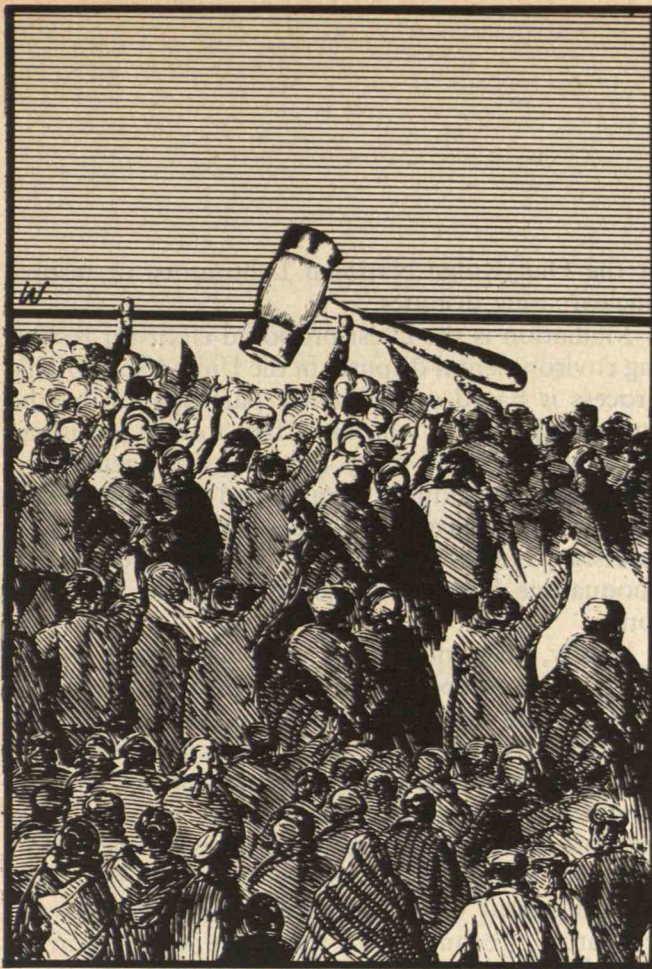
Public Consultation Models

The declining influence of the citizen in a technologically complex society is a pervasive concern expressed in many disputes. The proliferation of public inquiries, citizen advisory groups, and mediation councils reflects an effort to involve citizens more directly in the formulation of policy.

Public inquiries serve as a forum for comprehensive discussion of specific projects and as a channel for the expression of a range of opinions. The range of opinions normally considered by an inquiry can vary widely. At one extreme, the Canadian Berger Commission (created to assess impacts of the proposed Mackenzie Valley Pipeline) was extraordinarily open to nontechnical participation. "Alternative" opinions were especially sought, with intervenor groups being given financial support to develop their case. The Commission heard everyone from fishermen to legislators and considered political testimony as important as technical information. On this basis, Judge Berger recommended a ten-year delay in construction in order to settle native claims and establish programs for mitigating adverse social and environmental impacts.

Such an open procedure is unusual, however. In most commissions, the agenda is limited. They are generally dominated by scientists and pervaded by the belief that factual evidence should carry more force than subjective concerns.

This was the case in the 100-day public inquiry into the British plan for THORP, a thermal oxide reprocessing plant. The intention was to hear competing arguments in order to evaluate the "facts" of



If the controversy is defined in terms of alienation, a more participatory or consultative system is developed.

| Public consultation models | Who participates | General intention |
|--|--|--|
| Public inquiries: Windscale Inquiry (England) Berger Commission (Canada) Policy Intentions (Holland) Hearings (U.S.) | Scientists; interested public; local public authorities | Comprehensive discussion of a project or problem area to raise public awareness and to help officials decide issue |
| Complaint investigations: Declaration d'Utilite Publique (France) Atom Law (Germany) | Civil servants; interested public; scientists | To formulate objections based on individual or collective rights and to amend decisions |
| Citizen advisory groups (U.S.) | Community groups | To allow local community to influence a specific decision affecting local interests |
| Environmental mediation (U.S.) | Environmental groups; project developers; third-party mediator | To allow face-to-face confrontation over specific projects and to settle disputes |
| Referenda (U.S., Austria, Switzerland, Holland) | Voting public | To arbitrate a controversial decision by direct vote |

government policy, and hundreds of individual organizations testified. With no source of central coordination or funding, however, objectors had great difficulties in developing coherent and consistent positions to counter the arguments of British Nuclear Fuels, Ltd. The judge, left to interpret conflicting evidence, recommended construction of the reprocessing plant.

In the Netherlands, an elaborate public inquiry system has been developed on the principle that the public must be consulted on all decisions affecting the environment. All government plans are preceded by the publication of "policy intentions" which deal with political and philosophical questions: the objectives of growth, the goals of particular projects, and their likely impacts. These are widely distributed for public comment. Reactions are analyzed by a representative advisory group, and the appropriate ministry must answer criticism and justify or reformulate the policy. The entire dossier developed through this process serves as a basis for parliamentary decision-making.

Other inquiries are essentially inquests into public objections to specific projects. This is the purpose of the French *Declaration d'Utilite Publique* (D.U.P.) and certain provisions of the German Atom Law. To build a nuclear power plant in France, E.D.F. must undertake an inquiry through a "D.U.P." procedure. Originally developed as a forum for objections to

the practice of eminent domain, the D.U.P. has recently become a channel for the public to express concerns about environmental risk and personal safety. In the D.U.P. process, all people living within five kilometers from a proposed nuclear site have access to a technical dossier for six to eight weeks, during which time they can voice their objections. The prefect appoints an investigating commissioner, usually a local dignitary or a retired civil servant, who collects and evaluates the complaints and E.D.F.'s response. Using this evidence, he recommends whether the project should be given public utility status. Significantly, no commissioner has ever denied an E.D.F. application.

Under the German Atom Law, electric companies wishing to build a nuclear plant must apply to the Land Administration for a construction permit and hold a public hearing. Documents are available for public inspection for a month, and anyone affected by a project is entitled to object. The courts have accepted claims from people as far as 100 kilometers from the plant site, but the hearing is restricted to discussion of the nuclear aspects of the plant. Other environmental issues, and economic and social concerns, are considered irrelevant — a constraint that severely limits meaningful public participation.

In the United States, controversies have also generated citizen consultation procedures. For example, a citizen review board was formed in Cambridge, Mass., in 1976, to advise the Cambridge City Council on a policy for recombinant DNA research in the city. (See *"Genetic Engineering: The People's Choice,"* by Sara Jane Neustadt, *Technology Review*, December, 1976, pp. 10-11.) Its organizers contended that: "Decisions regarding the appropriate course between the risks and benefits of potentially dangerous scientific inquiry must not be adjudicated within the inner circles of the scientific establishment. . . . A lay citizens' group can face a technical scientific matter of general and deep public concern, educate itself appropriately to the task and reach a fair decision."

For four months this review board discussed the risks of DNA research. Despite the "lay" composition of the board, its mandate constrained members to consider only technical questions. They could not discuss long-range risks or ethical implications of the research. Ultimately, with a modification requiring local monitoring, they approved the proposed research under the federal guidelines set down by the National Institutes of Health. A similar citizen review structure has been proposed by a study group

at the Oak Ridge National Laboratory to resolve nuclear siting disputes.

Mediation is the latest proposed elixir for resolving environmental disputes in the United States. This process is based on voluntary participation by the contesting parties, who meet face-to-face in discussions with a third party (who acts as facilitator). Mediation procedures have helped to settle several environmental disputes (for example, the routing of Interstate Highway 93 in New Hampshire and the Snoqualmie River flood control plan in Washington).

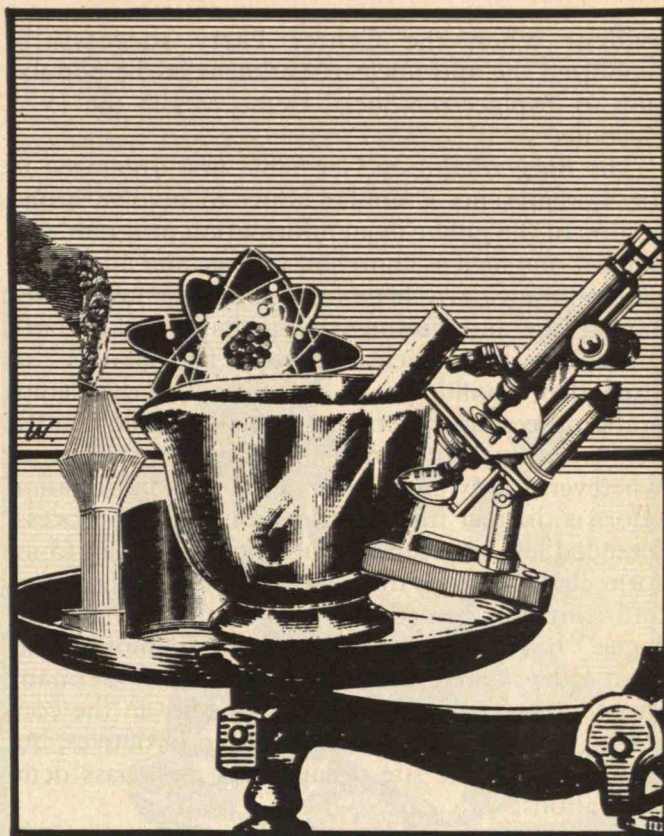
Finally, referenda are a growing feature of the political landscape. In the United States, thousands of referenda each year deal with a spectrum of questions from local property taxes to such broad technical issues as airport expansion or nuclear power plant development. Twenty-one states have petition procedures for placing issues on the ballot, 23 states permit direct legislation through voting, and 38 permit voters to review laws passed by the legislature. Technological issues are also appearing on ballots in Europe, with the most striking examples being the recent referenda on nuclear power in Austria and Switzerland. While posing significant problems — especially of representation, adequate information, and potential co-optation — the growing popularity of the referendum reveals the trend toward dealing with controversial technical questions through more participatory procedures.

Information Models

Access to information about controversial projects is a necessary precondition for public acceptance, but information can serve several ends. Governments devise ways to improve access to information, hoping this will enhance trust in administrative decisions; while critics seek greater access in order to influence such decisions. "Information," however, is usually controlled by an inner circle of scientists and officials, and what is released often consists of public relations materials.

In France, public information about nuclear power prior to 1974 consisted mostly of promotional material — E.D.F. would distribute comic strips to school children and glossy brochures to adults. As countergroups responded, however, it was clear that promotional material actually increased polarization. Therefore, E.D.F. cut back its public relations campaign in 1975 and established a *Groupe d'Information Nucléaire*. Then, in 1977, the

If the problem is defined in terms of inadequate information, the task becomes one of "education."



government set up the *Conseil d'Information sur l'Energie Electronucléaire* (Council for Information on Nuclear Energy), made up of scientists, officials and representatives from ecology groups. This council reviews the information on nuclear power available to the public, evaluates its quality and completeness, and recommends what should be publicized.

The Swedish government developed another kind of forum for distributing information in 1974, in response to the growing anti-nuclear movement. Using a system of study groups, managed by the principal popular organizations and political parties, the government financed a program to inform broad segments of the public about energy and nuclear power. This public education program involved some 8,000 study circles, each with about ten members, who met together to discuss those energy-related questions they felt to be most important. It was fully expected that greater information would create more favorable attitudes toward government policy. Yet reports from these groups showed the opposite — a continuing (and reinforced) uncertainty and ambivalence. This lack of consensus was only too

| Information models | Who participates | General intention |
|--|--|--|
| Conseil d'Information sur l'Energie Electronucléaire (France) | Scientists, high officials, reps. of ecology associations | Oversee all information from public agencies; recommend what should be publicized |
| Groupe de Belle-rive (International) Reflection Groups (Holland) Council for Science and Society (England) | Scientists; enlightened power elites | To enlighten decision-making and to generate discussion and publicize information about policy |
| Study Circles (Sweden) Burgerdialog (Germany) | Large voluntary associations and their constituencies; scientists; public at large | Broad debate over a problem area to raise public awareness |
| Environmental impact statements (U.S.) | Environmental groups; public at large | Improve access to documents on proposed projects |
| NSF — Science for Citizens Program (U.S.) | Scientists; environmental groups | To improve public access to scientific expertise and information |

evident when the Center Party successfully mobilized the anti-nuclear sentiment in the population to displace the Social Democrats in the 1975 elections.

The *Bürgerdialog* in Germany, first organized in 1974, represents a similar effort to involve broad sectors of the public in an information program. Organizations such as churches, unions, and adult education groups have been funded to organize discussion groups and meetings that include speakers both for and against nuclear power. The goal is "to strengthen confidence in the ability of the democratic process to function, especially in the controversy over nuclear energy, and to restore confidence wherever it may be undermined." This information effort is distinct from the decision-making process, intended less to ascertain public opinion than to inform citizens about the necessity for nuclear energy and convince them that risk is minimal. The "dialogue" has thus frequently become a monologue. That it has failed to create consensus in Germany over nuclear policy is evident not only in the continued growth of anti-nuclear citizen initiatives, but in often dramatic site occupations and mass demonstrations.

The creation of elitist *ad hoc* groups — which can rise above the polarization characteristic of so many disputes — represents another attempt to develop consensus by expanding information. Most groups of this kind are not officially linked to government. They seek a membership that will satisfy both public opinion and governmental authorities, and they try to be a responsible and respected source of public information about the effects of science and technology. For example, the *Groupe de Bellerive*, an international council "for reflection and evaluation," was formed out of concern about the violent opposition to nuclear power in Europe. Its purpose is to bring together "minds both enlightened and recognized as such (scientists but also jurists, technicians but also philosophers, economists but also the politically aware, leading bureaucrats but also those elected by the people), capable of analyzing complex problems and forming independent judgments."

The British Council for Science and Society, organized in 1973, assesses new developments in science and technology for their potential social impacts. It includes scientists, lawyers, and philosophers who meet to consider contemporary problems and to stimulate informed public discussion.

Similarly, *ad hoc* reflection groups coalesce from

time to time in the Netherlands to discuss controversial policy issues and then inform the public. In 1974, for example, a reflection group of scientists, parliamentarians, industrialists and journalists examined the social and economic dimensions of the nuclear program, and called for a five-year reflection period to rethink the basis of national planning. With no formal decision-making authority, all such groups exercise influence mainly by trying to create an informed citizenry and attracting the attention of the media.

Problems of Procedural Acceptability

We have surveyed a variety of procedures intended to avoid or to resolve the controversies that obstruct so many decisions about science and technology. Most of these procedures rest on a traditional "welfare model" — in which risks are defined as problems to be dealt with, mainly by experts. It is assumed that if a problem is solved by a respected group of elites or by using the best available scientific opinion, this will enhance the legitimacy of public authorities. And it is assumed that adequate information will contribute to consensus. Yet conflict and mistrust persist, and the procedures themselves are often debunked. Neither public participation nor enlightened representation appear to assure the acceptability of controversial technologies. This is because test groups generally see the issue of risk less as a problem to be solved than as a controversial question requiring dialogue and negotiation.

What then must one do to enhance legitimacy? What kind of procedures would be acceptable to critical groups? To explore the sources of persistent cynicism about procedural reforms, we turn to five questions frequently asked by opposition groups:

- ☐ How are the boundaries of the problem defined?
- ☐ Who participates in the experiment?
- ☐ Who conducts the procedure?
- ☐ What is the distribution of technical expertise?
- ☐ Is there really a choice?

Definition of the Problem

A first principle of negotiation over controversial policies is that there be mutual recognition of the real source of conflict. Is opposition to a technology really based on concern about risk, or is this just a surrogate for more fundamental social concerns? Highly political issues are too often defined as

technical — under the assumption that agreement about technical issues will somehow help to resolve questions of political choice — and the fundamental impacts of a technology on community values remain unexamined.

This definitional bias is most obvious in experiments such as the Science Court — in trying to differentiate facts from values, they ignore the subjective interpretations that enter even into the collection of data. In the social and institutional context of science and technology today, it is highly anachronistic to seek resolution of conflicts through scientific expertise. Moreover, even if technical consensus could be established, this may have little effect on public attitudes. Technical consensus may narrow the range of choices, but procedures that bypass underlying value concerns will have little effect on the resolution of disputes.

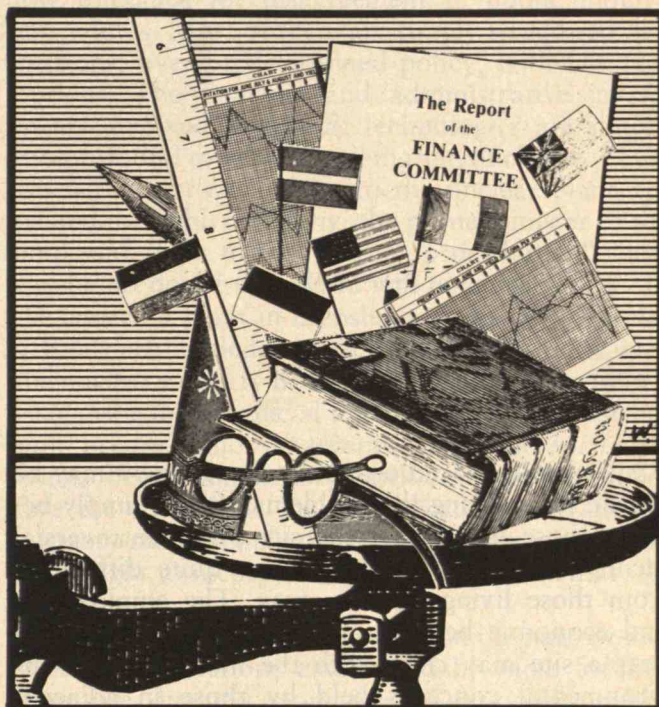
Yet commissions and inquiries also tend to give disproportionate weight to technical evidence over subjective concerns. For example, the German hearings required by the Atom Law restrict discussion to the technical questions of nuclear risk, avoiding discussion of the economic and social issues that are often the primary concern of the nuclear opposition. Even in the broadly participatory citizens' review board in Cambridge, Mass., the agenda, set by academic scientists, was narrowly defined as assessing short-range health hazards and stipulating adequate safety measures. Questions of long-term risks and benefits, and of ethics, were put aside.

Similar questions of problem-definition occur in efforts to improve availability of information. How does one select the materials to be released to the public? Information on sensitive topics, such as the extent of policy controls over nuclear facilities or evacuation plans in case of accidents, are often excluded from circulation despite, or perhaps because of, their political importance.

Who Participates?

A second principle of negotiation is that participation must include appropriate interests. In most procedures, two criteria are used to establish the right of participation: "affected interests" and "representativeness." The interests affected by a project are often defined by geographic proximity, but this criterion is flexible. The German nuclear inquiries have no geographic limits to participation in public hearings, while the French restrict participation to a five kilometer radius from a proposed site.

If the problem is thought to arise from insufficient technical evidence, this leads to a structure based on scientific advice.



| Advisory models | Who participates | General intention |
|--|---|---|
| Science Court (U.S.) Energy Campaign (Austria) Gorleben Review (Germany) | Scientists and public officials | Adversary procedures to establish consensus on "scientific truth" that will lay a basis for public policy |
| Advisory Commissions of Science and Technology Ministry (Germany) | Scientists; representatives of major institutions | A comprehensive discussion of a project or problem area |
| Regional Concertation (France) | Local dignitaries, state officials, engineers | To reach local agreement in order to implement national policies which affect the local environment |
| Royal Commissions (England) | Experts and public officials | Comprehensive discussion to achieve agreement on a controversial issue |

Is opposition to a technology really based on a concern about risk, or is this just a surrogate for more fundamental social concerns?



Such limits placed on public involvement may be crucial in assessing the problems of risk, simply because those living near the site of a controversial facility may evaluate the project quite differently from those living further away. The employment and economic benefits anticipated by those living near a site may clash with the more abstract environmental concerns held by those in adjacent communities. Conversely, neighbors of a nuclear facility may feel that they unjustly bear the risks of a project intended to benefit a wider region.

The notion of who is representative, and therefore entitled to participate, also varies. In Sweden, study circles were broadly participative, but organized by a relatively small group of trusted representative elites (the leaders of major associations and political parties). In France, with its comparatively limited tradition of voluntary association, representatives are usually civil servants or local elected officials. In the United States, participation is often more direct, as in the Cambridge Citizens' Review Board.

In some inquiries, the question of who should be involved is avoided by the use of a public referendum. Local governments in France, for example, have organized referenda on nuclear power plant siting. These, however, serve only as a source of information. They are neither decisive nor do they necessarily create consensus, for they fail to account for the intensity of opposition from small but actively critical groups.

Problems of participation can also limit the use of mediation procedures. Mediation works best when two major protagonists share a minimum common interest that will lead to a mutually satisfactory compromise. But in technological controversies, opposing groups are not necessarily well defined, and they do not necessarily share the values that will enable a compromise.

Who Runs the Show?

A major criticism of consensus procedures concerns their management — the choice of commissioners and of various supervising and consulting agencies. In Germany, the civil servants in charge of public hearings often serve, simultaneously, on the administrative boards of the utilities that are applying for permits. For example, the minister of economics, politically responsible for the nuclear inquiry procedure in Wyhl, was also the active vice chairman of the board of directors of the utility. And the consultant for the licensing process — the large, state-run Institute for Reactor Safety — had been formed from the first generation of enthusiastic German nuclear experts. Such groups are unlikely to raise critical questions, and may systematically reject information that comes from outside the nuclear establishment.

In France, the commissioners who preside over the public inquiry procedures are also suspect. Often retired civil servants, they lack the technical competence to evaluate the details of E.D.F.'s studies. Yet they maintain a monopoly of information in the D.U.P. nuclear siting procedures. The fact that no commissioner has ever denied an E.D.F. application suggests the limits of this procedure.

Distribution of Expertise

Because disputes are so often translated into technical terms, resolution of conflicts requires a reasonable distribution of expertise. Indeed, expertise is a crucial political resource, and if parties in conflict are to have any sense of political efficacy, they must have access to technical advice. In major inquiries, such as that involving THORP, the lack of technical resources among intervenor groups seriously undermined their ability to present an effective counterargument. The French program for regional concertation has been criticized as a "phantom consultation" because regional councils lacked the expertise to evaluate E.D.F. technical dossiers on

proposed nuclear sites. Thus, they could only respond in terms of traditional political alignments.

Inadequate distribution of expertise allows an unbalanced control of information. The *Conseil d'Information* in France can only respond to the information made available by public authorities. It cannot generate its own information nor can it insist that information be released. Thus, while leaders of ecology associations agree that the *Conseil* is a channel for important information, they call it a bluff — simply another way to subdue opposition.

In the German nuclear inquiries, only those documents that are part of the formal application (to construct a plant) are officially open to the public. Internal administrative evaluations are available on request, but only at the discretion of the administration.

Control over information and its distribution — i.e., the selection of the technical data — may predetermine final decisions. Aware of the political implications of maldistributed expertise, *ad hoc* public-interest science groups have organized in many countries. They include Science for the People in the U.S., the *Wetenschapswinkels* (or “science shops”) in the Netherlands, the Health Hazards groups in England, *Groupe de Scientifique d'Information sur l'Energie Electronucléaire* (Scientist's Group for Information on Nuclear Energy) in France, and various “reflection” groups in Holland and England. Some of these groups have formed to create an independent means for evaluating new developments in science and technology, and they attempt to rise above the polarization that is characteristic of so many disputes. Others are more activist, specifically making expertise available to environmental and anti-nuclear groups who lack the ability to generate technical information for themselves.

Is There Really a Choice?

In 1977, a public inquiry for a nuclear plant was opened at Le Pellerin, France, where local resistance had long been evident. The mayors of seven out of twelve communes in the region had refused to use their offices for the inquiry, and documents had been stolen and burned in two city halls. The prefect decided to open an “annex” under police protection, even though the population had indicated it would boycott the official inquiry altogether. Of the few people who did participate, 95 approved the project and 750 opposed it. Anti-nuclear petitions in each of

several municipalities were signed by 80 to 90 per cent of the population. But the outcome of the inquiry, despite such outright opposition, was that the commissioners declared themselves incompetent to judge the issue and then proceeded to rule in favor of the project.

This is an extreme example, but it suggests the low tolerance for disagreement in public inquiry procedures. Most of them are simply structured discussions, over predetermined policy, with few real options. The financial and administrative investments involved in specific technologies are simply too profound to allow a real margin of choice. Thus, when the first opposition to the nuclear plant appeared in Wyhl, Germany, the prime minister of the land said, *prior* to the licensing procedures: “There can be no doubt that Wyhl will be constructed.” In the case of a plant in Esensham, Germany, regional officials acknowledged that secret negotiations with the nuclear industry had taken place for more than a year prior to the official application for a construction license. And in several cases, *Electricité de France* began preparatory work on construction before the end of the inquiry procedures. Of all the advisory models, only the Dutch “policy intentions” has sought to incorporate public opinion at an early stage.

The limits of choice are evident in the narrow and short-term questions entertained by most forums. They are directed more toward co-opting public support than changing decisions; more toward seeking informed consent than expanding democratic choice. Determination to implement preconceived decisions leads officials to ignore, to debunk, or simply to be unaware of opposition. And this results in the transfer of conflict from the hearings to the courts, and often to the streets.

Conclusions

Governments in most highly-industrialized countries share a common set of political problems: how to reconcile technological systems with social values; how to develop sufficient consensus over controversial technologies to permit continued growth; and how to clarify citizen interests, and generate the political support for making authoritative and acceptable decisions. The inadequacy of existing institutions to deal with these problems has inspired many experimental procedures, some of which have been briefly described in this article. Such experiments open up a range of possibilities for institu-

tional change, and they suggest a set of criteria for successful negotiation. But we wish to emphasize that they provide no systematic solutions.

Comparative policy studies often approach common problems, seeking a "best solution" that can be transferred to other contexts. Our analysis is not to be interpreted in this way, for we find that the structure of these experiments — in response to the definition of "appropriate" procedures — is a wide-ranging function of national political styles, expectations about the role of government, and local mechanisms for citizen participation.

The approach to solving conflicts in a political context of consensus and compromise will differ from that in an adversary culture. Holland, with its tradition of cleavage (reflecting religious and regional differences), has had long experience in accommodating competing interests. It can be expected to develop procedures quite different, say, from those in Sweden. The French tradition — of open ideological factions within a centralized political and administrative structure — calls for different conflict-resolving procedures than in Germany, where consensus may be expected through internal negotiation within major political parties and labor unions. The structure of experiments, and the assumptions about who should participate, reflect basic political differences and cannot be simply transferred without considerable adjustment. Indeed, transferring means of conflict resolution can pose problems not unlike those of technology transfer.

What can be generalized is not the structure of the experiments, but the conditions that will allow dissenting groups to express their concerns and to communicate effectively with administrative agencies. These conditions include: a "formula" that gives due weight to social and political factors; appropriate involvement of affected interests; an unbiased management; a fair distribution of expertise; and a real margin of choice. Actually, such procedural conditions are not likely to produce consensus, but they may reduce public mistrust and hostility toward political and administrative institutions in order to at least allow détente. Our conclusion, in fact, is that détente is a more appropriate and realistic goal.

Recent disputes have taught us a lesson — that decisions about risk are not simply matters of sufficient technical evidence or adequate information. Substantive issues are at stake which embody highly controversial political and social values.

Thus, the resolution of conflict is not always possible, and seeking consensus is like wanting 100 per cent risk-free technology — hardly a feasible goal. It is only through accommodation — the working out of conflicting values — that new political relationships, appropriate and acceptable in advanced technological societies, can evolve.

Selected Readings

For details on specific procedures see:

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Dorothy Nelkin is a professor in the Program on Science, Technology and Society at Cornell University and president of the Society for the Social Studies of Science. She has published a number of books on politically controversial areas of science and technology, and on citizen participation in decisions concerning technology, drawing from research both in the United States and Europe. She is author of several books including *Controversy: Politics of Technical Decisions*, *Technological Decisions and Democracy*, and *Science Textbook Controversies and the Politics of Equal Time*. Michael Pollak is a research associate in the Program on Science, Technology and Society at Cornell University. He studied sociology in Austria and France and has a Ph.D. from the Sorbonne. He worked at the OECD's Directorate for Science, Technology and Industry and as a consultant for the French Ministry of Planning. He has published books on social science policy and on French sociology. Nelkin and Pollak are presently writing a book together on the nuclear energy controversies in France and Germany.

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The utilization of icebergs as a source of fresh water is a promising, if elusive, possibility.

The Iceberg Cometh

by W. F. Weeks and Malcolm Mellor



Illustration: Mark Fisher

Limits to human activity are set by the availability of fresh water. When the demand outstrips the local supply, or when the local sources have been contaminated, the conventional modern practice is simply to “borrow” water from some other region, usually by pipeline or aqueduct. But with growing population, industrialization, and pollution, the search for new water supplies has become increasingly difficult, and sources farther and farther afield are being considered.

Melting icebergs is one of the most “far-out” of these suggestions. This may appear, at first glance, to be technically or economically infeasible, or to be an engineer’s infatuation that will soon pass. But “iceberg water” has become the object of serious study in recent years, and — although much remains to be done, including the first live demonstration of the idea — it may have considerable promise.

Here we would like to briefly describe the nature of the resource, the principal technical problems and some of their proposed solutions, the costs and benefits of the idea, its impacts, and, of course, its future prospects.

Is the Earth short of water?

Hardly. Overall, we have roughly 1.4 billion cubic kilometers of it. But only about 9 million cubic kilometers — or six-tenths of one per cent of the

total — is both liquid and fresh. This is still a lot of water, but it is distributed unevenly and, in general, its quality deteriorates as the demand rises at a given location. Perhaps more important than the absolute quantity of fresh water, however, is the rate at which water is replenished: the amount of fresh water recycled annually by evaporation is less than half a million cubic kilometers, and of this less than a quarter (or about 0.1 million cubic kilometers) falls as precipitation over land areas. The useful supply tends to be limited to about 10 to 20 per cent of the precipitation — about 10,000 to 20,000 cubic kilometers.

With liquid fresh water being such a scarce resource, and the subject of this presentation being iceberg water, what then is our "inventory" of fresh water-stored-as-ice?

Almost 30 million cubic kilometers. About 90 per cent of this ice is contained in the continental ice sheet and the ice shelves of Antarctica. Most of the rest is in the Greenland Ice Sheet. Less than 1 per cent is distributed among the ice covers of the arctic and subarctic islands and the world's mountain glaciers. These accumulated "frozen assets" yield meltwater of very high purity, although airborne pollutants originating from human activity are beginning to accumulate in the upper layers.

The Antarctic Ice Sheet has an annual input of precipitation equivalent to about 2,000 cubic kilometers of water, and its ice shelves, in turn, produce tabular (i.e., flat) icebergs containing roughly 1,000 cubic kilometers of water. The Greenland Ice Sheet is smaller, with an annual iceberg production equivalent to about 200 cubic kilometers of water. Altogether, the iceberg production rates for Antarctica and Greenland are equivalent to about 20 per cent of the precipitation over the continental United States.

The appealing things about Antarctic tabular icebergs are their neat packaging (uniform slabs 200 to 250 meters thick) and comparative accessibility for potential users in the Southern Hemisphere. By contrast, most Greenland icebergs are appreciably more irregular in shape and size. Furthermore, they are not well placed for delivery to coasts where water is in short supply.

The Antarctic icebergs alone comprise an annual potential water source equal to five times the world's current domestic use of water, and one-third of the consumption for all purposes.

Who thought up the idea of iceberg water?

Modern interest in the idea should be credited to John Isaacs of the Scripps Institution of Oceanography, who suggested (in his unpublished study during the early 1950s) that iceberg water was a possibility for Southern California. The first people to write something down, thereby exposing the idea to the scrutiny of the geophysics and engineering communities, were W. F. Weeks and W. J. Campbell. At a Symposium on the Hydrology of Glaciers in 1969, and in a paper published in 1973, they presented calculations suggesting that iceberg water could well be an attractive option for certain selected sites in the Southern Hemisphere. This was followed, later in 1973, by a report prepared by J. Hult and N. Ostrander (of the Rand Corp.), who returned to a consideration of the Isaacs suggestion of iceberg water for Southern California. They also decided that the idea looked quite promising.

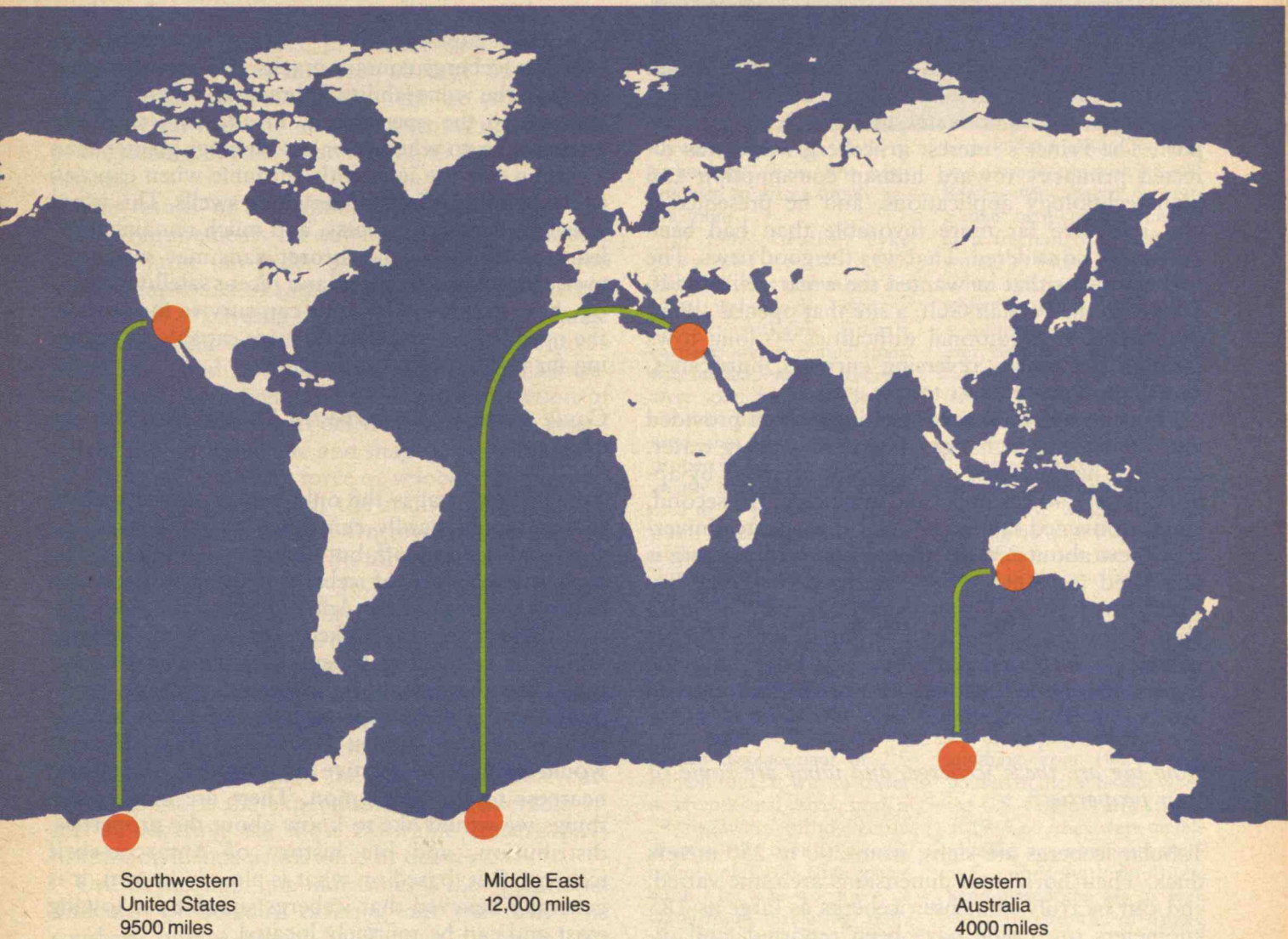
These two studies were similar in some respects: both pairs of authors became intrigued with the idea of iceberg towing; they saw potential economic advantages in large-scale operations; and they assumed that the major uses of such water would be irrigation or industrial processes. Otherwise, the studies were very different: Weeks and Campbell discussed the towing of individual, unprotected icebergs to the easiest locations (Australia and western South America), while Hult and Ostrander examined the towing of trains of "wrapped" icebergs to sites north of the equator.

These papers received considerable publicity in the press (icebergs appear to fascinate journalists) as well as discussion in technical circles, with comments ranging from "brilliant" to "crazy." However, all in all, not much happened.

Wasn't there any developmental pressure from potential users (especially those in arid regions)?

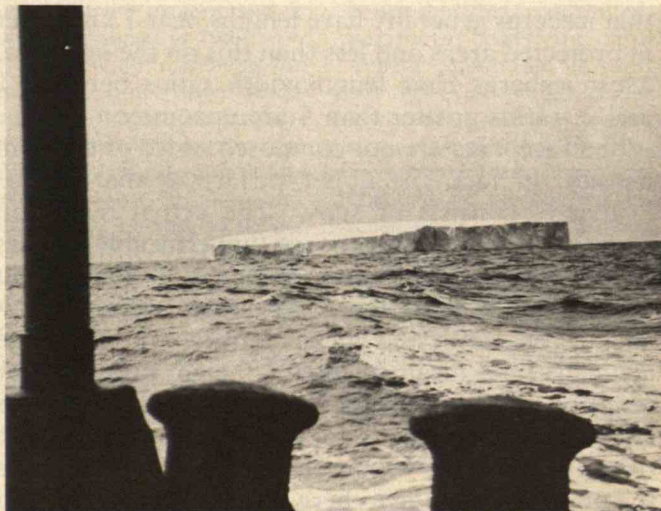
Yes. What iceberg water needed was a patron, preferably one with considerable financial resources and an incentive to act. He arrived in the person of Prince Mohammed Al Faisal Al Saud of Saudia Arabia, who had become interested in the possibility of iceberg water through the entrepreneurial initiatives of Paul-Emile Victor, a noted French specialist in the polar regions.

Charged with responsibility for developing his country's water supplies, Prince Faisal had truly serious water problems. In a country that has no pe-



Above: The towing distances to three regions of interest show the wisdom of focusing initial efforts on delivery to Australia.

Right: A tabular iceberg, about half a kilometer wide, as it might be viewed from a towing vessel.



rennial rivers, average rainfall less than four inches per year, and depleted aquifers, one must consider *all* possibilities — desalination, weather modification, import of liquid water, and even iceberg transport. The Prince's interest in iceberg water was directed primarily toward human consumption and high technology applications, and he presented a cost structure far more favorable than had been previously considered. That was the good news. The bad news was that he wanted the water delivered to Jeddah in the Persian Gulf, a site that opened a Pandora's box of additional difficulties — long tows through hot water, reversing currents, hurricanes, and shallow water, just to cite a few.

Prince Faisal sponsored meetings which provided a forum for the exchange of ideas on iceberg water. The first, held in Paris in 1977, was attended by approximately 40 scientists and engineers; the second, which convened late in 1977 at Iowa State University, drew about 230 people; and a third meeting is scheduled for April, 1980, at the Scott Polar Research Institute in Cambridge, England. The Iowa State Conference resulted in a large, wide-ranging volume — *Iceberg Utilization*. This book, plus the papers mentioned earlier, comprise the required reading on the subject.

How big are these icebergs, and what are some of their properties?

Tabular icebergs are slabs, from 200 to 250 meters thick. Their horizontal dimensions are quite varied, and can be truly immense: icebergs as large as 185 kilometers on a side have been reported, and dimensions in excess of 50 kilometers are not uncommon. Based on very limited observations, it appears that icebergs generally have lengths near 1 kilometer in protected areas and less than this on the open sea. Most icebergs have length/width ratios between 1 and 2; ratios greater than 5 are uncommon.

Shelf icebergs are not composed of ice of uniform density. In fact, the upper surface at the time of "calving" consists of snow. The actual transition from snow (permeable) to ice (impermeable) occurs at depths between 40 and 60 meters, depending on the origins of the iceberg. Although iceberg buoyancy varies with the mean density and the edge geometry, the mean freeboard (height above water level) of tabular icebergs is about 40 meters. These are important numbers: for example, if the snow-ice transition is below sea level, sea water can infiltrate the upper part of the iceberg and perhaps cause it to

deteriorate rapidly.

Many icebergs contain cracks and crevasses that increase the vulnerability to break-up when they are exposed to the open ocean. In addition, there are questions as to whether or not icebergs greater than a certain size are inherently unstable when exposed to the bending effects of very long swells. This is not a well-understood process, and much remains to be learned. Whatever the theoreticians may say, however, ship-board sightings and recent satellite studies do show that some icebergs can survive for years in the open ocean, and that they are capable of voyaging far to the north on their own.

Could icebergs be "harvested," therefore, from the open sea?

Yes. In fact, that is the only way. A smart iceberg tow-er would hardly run down to the nearest ice shelf and saw one off, but would watch satellite images to keep track of icebergs drifting to the north beyond the edge of the Antarctic pack ice. After letting natural selection take its toll, several icebergs would be selected as potential candidates for towing. Then they would be inspected, perhaps by remote sensing techniques such as radio-echo sounding, to disclose hidden flaws. The final selection would be based on relative integrity, size, shape, and nearness to the destination. There are many more things we would like to know about the properties, distribution, and life history of Antarctic-shelf icebergs. But, based on what is already known, it is generally believed that icebergs suitable for towing exist and can be routinely located.

"There it is! But can we tow it?"

In principle, the answer is "Yes." Several theoretical simulations of iceberg towing have been made in order to gain a feel for the forces and velocities involved. Important parameters include tow boat capabilities, form and skin drag, waves, wind, ocean currents, Coriolis effects (deflections induced by the earth's rotation) and, of course, melting. There are many points that can be debated in these simulations. For instance, as the iceberg is towed, differential melting ought to streamline the overall shape, causing a decrease in the form drag. At the same time, large melt-induced ripples form on the ice surface, perhaps increasing the skin drag. There is also undercutting of the sides by wave action, resulting in subsequent collapse of the ice cliffs. The melting

process is itself complex, in that the fresh meltwater produces buoyancy-induced natural convection along the iceberg's sides. Also, the ice contains air which, when freed by melting, streams up the sides of the iceberg, further contributing to the convective process.

The results of the simulations suggest that the power requirements for towing icebergs of modest size are large (an order of magnitude beyond the current capability of single tugs), but are not beyond the bounds of existing technology. Within the range of iceberg sizes examined (horizontal surface areas of 1.5, 4, 7, and 10 square kilometers with thicknesses of 0.23 kilometer), the predicted proportion of the iceberg remaining at delivery seems quite insensitive to the original size and shape, but strongly dependent on the towing force or velocity (as the towing force increases, both the transit time and the amount of melt decrease). On tows of unprotected icebergs to Australia (30° S), for example, estimated yields are approximately 50 per cent with transit times between two and three months. Obviously, a great deal of ice is lost in transit, but it is still possible to deliver a lot of water.

An important factor in optimizing a tow appears to be the selection of an iceberg that is, at the time of pickup, in a location which minimizes the towing distance and maximizes the use of favorable currents. In short, the expenditure of considerable effort in locating the most favorable iceberg pays healthy dividends at the time of delivery.

One of the main imponderables is the operational difficulty of actually carrying out the tow. The southern oceans would hardly win an award for placidity. Because they are so large, tabular icebergs would not be too much affected by sea states, but the same cannot be said for tug boats. At present, the anticipated method of engaging an iceberg would be to encircle it with a line or net system. The installation of conventional bollards (strong posts for holding the tow line) also appears possible, although it is probably not a good idea to fix hardware into the ice. (What is secure on one day may melt loose the next.)

One major problem is that existing tugs are very inefficient devices for low-speed pushing and pulling, at least in terms of energy consumption. The "bollard pull" of a tug is not likely to exceed 30 pounds of force per shaft horsepower, resulting in an efficiency of less than 10 per cent at a towing speed of one knot (even ignoring power transmission losses in the ship); the world's most powerful



Developments in "iceberg technology" have not been confined to water supply applications.

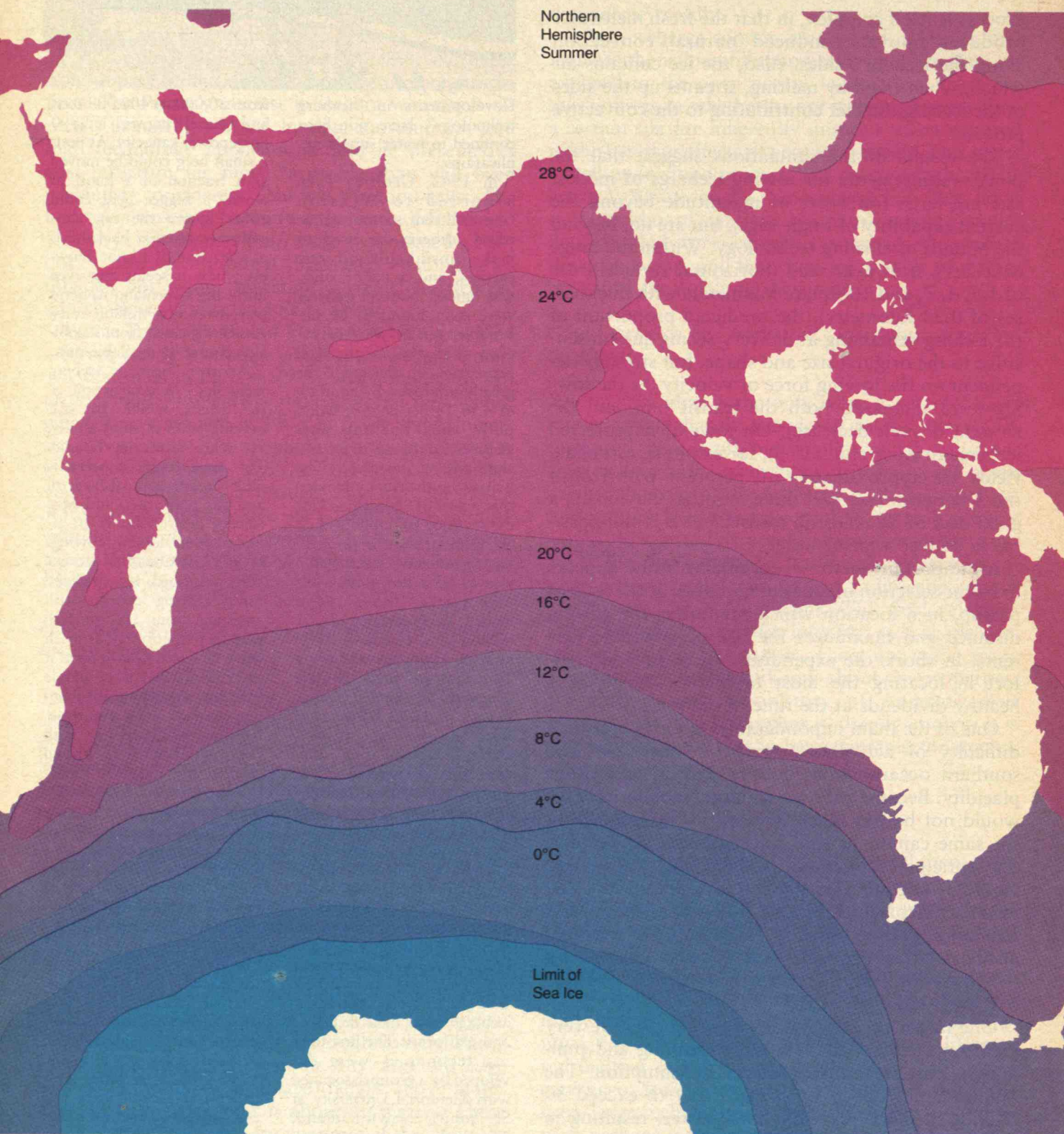
In 1942, Geoffrey Pyke proposed to Winston Churchill that natural or artificial icebergs be used to make unsinkable aircraft carriers, and a major study was funded. Natural icebergs were soon found to be unsuitable, but it was discovered that the mechanical properties of ice could be greatly improved by addition of 4 to 14 per cent of wood pulp, thus opening possibilities for the use of ice as a shipbuilding material. The British authorities decided that a fleet of "bergships" for the invasion of Japan should be built from "improved" Newfoundland ice. Each ship was to be a box with walls nine meters thick and a loaded displacement of 2.5 million tons. It was to travel at seven knots, driven from a 24-megawatt turbo-electric generator by over 20 electric motors of 1,100 horsepower each. It was to have a waterproof insulating skin, with the ice maintained at -15° C by artificial refrigeration. But wartime events overtook the project, and it was abandoned in 1944.

The towing of icebergs for purposes other than water supply is already an accomplished fact. In the waters off Newfoundland and Labrador, several oil companies are relying on tugs to deflect Greenland-originated icebergs from their drillships and platforms. The first towing techniques were developed by a group associated with Memorial University at St. Johns, Newfoundland. The earliest tests involved icebergs estimated to weigh

from 80,000 to 400,000 tons and a supply tug with a 2,800 horsepower capacity. At best, a small berg could be moved at a fraction of a knot; at worst, a bigger berg could either ignore the tug altogether or move it backwards at a fraction of a knot. However, now it seems that even fairly big Greenland icebergs (say, over one million tons) can be deflected from a collision course by available tugs.

Another facet of iceberg technology is destruction of the beasts, which are still making holes in ships almost 70 years after the *Titanic*. The most recent concern is with the safety of offshore oil and gas platforms, and here iceberg destruction is an alternative to iceberg towing. In 1927, a Canadian ice expert published his "recipe" for destroying icebergs with anything from 100 to 500 pounds of thermite. But when the U.S. Coast Guard tried it in 1959-60, they were unable to inflict any significant damage, either with multiple, hand-placed charges or with thermite bombs dropped from aircraft.

Since then, we have done a lot of work on cratering, bench blasting, controlled-perimeter blasting, and iceberg demolition. It turns out that even though ice has low strength and low density, it is almost as difficult to blast as ordinary rock, being very effective in attenuating intense stress waves. The best possible yield is about four cubic meters of broken ice per kilogram of explosive, so that demolition of icebergs by explosives is prohibitively expensive, at least until one can buy cheap tactical nukes at the army surplus store. W.F.W. and M.M. □



An approximate mapping of mean surface water temperature.

tugs have less than 200 tons of pull. But the towing resistance of a small tabular iceberg could be of the order of 1,000 tons at a constant speed of one knot. This suggests using several tugs to do the job, but the required number can escalate rapidly if higher-speed tows are required. Because much of the resistance is of an inertial nature, towing force increases with the square of velocity and the required power increases with the cube of velocity — i.e., doubling the speed calls for four times as much force and eight times as much power.

It will also take a fairly substantial piece of string to pull the ice cube. Just about the strongest cable manufactured for marine use is six-inch wire rope, which weighs 65 pounds per foot. The nominal breaking load of this stuff is around 1,500 tons, which means that a safe working load is way below the one-knot towing resistance of even a small berg (a safety factor of 5 is common, and 3 is the minimum).

There is no shortage of potentially innovative ideas for the towing operation. A Massachusetts group designed an efficient propeller for iceberg tugs, but it turned out to be 50 meters in diameter. The late Jonathan Job (of the University of Adelaide) favored the idea of pulling against a submerged drogue — an underwater parachute system. Prince Faisal and a colleague are reinventing the feathering paddlewheel for greater energy efficiency, while we ourselves are reinventing chain ferries and kedging systems (which use fixed points on the ocean floor to achieve propulsion through pulling). A more sporting approach would be to do the trip under sail, making a long spinnaker run through the southern ocean.

Given the many operational unknowns and uncertainties, the best way to realistically appraise the problems will be to try test tows on a modest scale. This would permit evaluations of a variety of techniques, it might resolve some existing debates, and it could identify problems not yet anticipated.

If we are melting 50 per cent of our tow on a trip to Australia, what about tows to California and Saudi Arabia?

Serious students of the problem are generally in agreement that an unprotected iceberg will not survive a tow north of the equator. Regardless of how large a shelf iceberg may be in the horizontal plane, it is still only 200 to 250 meters thick. Once the

flat-plate melt exceeds the ice thickness — Poof! No iceberg.

When the route from Antarctica to Saudi Arabia is examined, for example, one finds that even in July, when things are “cool,” the tow would have to traverse over 5,600 kilometers of water with temperatures in excess of 20° C (much of the route is, in fact, warmer than 25° C). It takes 128 days to make the transit, and even with water temperatures of only 20° C, the iceberg melts in 104 days. This also neglects the appreciable melt losses that would occur south of the 20°-C isotherm (*see pages 69 and 72*).

What is a matter of debate is whether or not a tabular iceberg can be effectively and inexpensively isolated from the surrounding seawater. Here we stress *inexpensively* (we could, in principle, build a refrigerated floating drydock and transport the ice in frozen comfort). Some people favor the use of protective fabrics that would help retain a layer of cold water next to the iceberg. Others have suggested the use of foamed insulation. But a panel that met at the Iowa State meeting concluded that protection was truly a formidable problem. Although there was no general agreement on the elements of an adequate protective scheme, it was stated that foam alone would not be successful; that plastic films and wraps would be both difficult to handle and maintain; that effective protection near the water line is crucial, but on tows across the equator both the sides and bottom of the iceberg will require protection; and that proposed solutions ought to be simple if they are to work under the severe environmental conditions that would be encountered on an operational tow.

So far, we have not heard of a protective scheme that we can believe in. The task of protecting the near-vertical 200- to 250-meter-high sides of an iceberg during tow is truly formidable. The physical danger of operations near these ice cliffs cannot be overemphasized. Yet from the history of engineering advances we would be foolish to say that it cannot be done; it is just that we do not have a good idea of how to do it.

For tows north of the equator, protection is essential. But for tows to Australia or other Southern Hemisphere sites along western South America or southern Africa, it is not. Thus, it makes sense to focus initial efforts there. In addition, if *partial* protection could be arranged during a Southern Hemisphere tow, it would make operations more favorable in that it would greatly increase the amount of iceberg that would arrive at the delivery site.

What are the economics of delivering an unprotected iceberg to a site in Australia?

Job's calculations (presented at the Iowa conference) suggest a delivery cost for small icebergs of between 5 and 15 cents per cubic meter of water. He also points out that with the development of efficient towing and an increase in the scale of the operations, the delivery costs might be lowered considerably, to the neighborhood of one cent per cubic meter. This figure compares with the initial estimates made by Weeks and Campbell for large-scale operations.

These costs place limits on the possible initial uses of iceberg water (assuming that early transportation schemes, and the quantities delivered, are modest). Water for urban and industrial requirements may be worth 15 cents per cubic meter or more, depending upon the need and market conditions. The cost for bulk fresh water produced by large-scale desalination in Saudi Arabia, for example, is 90 cents per cubic meter, and in some countries water costs are as high as \$2.50 per cubic meter. In Australia, at the present time, no water user near a capital city faces charges in excess of 20 cents per cubic meter for piped delivery. However, charges of 20 cents per cubic meter for excess water have already been levied on consumers in Adelaide, and during the 1966-1967 drought in Melbourne many owners of swimming pools had them filled from road tankers at cost of \$2 per cubic meter. Fresh water is at present in short supply in parts of southern Australia, and although the present distances between sources and cities have resulted in costs of less than 20 cents per cubic meter, the larger distances to new water sources will undoubtedly result in appreciable price increases. For instance, Perth is considering tapping the Ord River system in northern Australia, a distance of more than 2200 kilometers.

In short, it appears that because of increased water demand and dwindling supplies, iceberg water could, within the next 20 years, offer an increasingly attractive alternative to conventional water supply in parts of southern and western Australia.

What does one do when the iceberg arrives?

This question has not received nearly the attention it deserves. First, because of the iceberg's draft (the thickness of the submerged portion), it is not possible to deliver it "on the beach." In western Australia, for instance, you could only get to within 15 kilometers of Rottnest Island, and in South Australia

your journey would end some 35 kilometers from the main coast. Hardly what one would wish! There, the iceberg must be moored or otherwise immobilized and protected from the surrounding seawater so that the fresh meltwater is contained. Finally, there is the job of systematically processing the ice into water — by no means a trivial operation. Certainly the iceberg cannot be allowed to sit around for years, basking in the sun, as it represents a large capital investment. It must be efficiently processed, so that we are ready for the next iceberg to arrive. Does one cut it, core it, blast it, saw it, crush it, or slurry it? An overall analysis of the possibilities has never been made.

More enlightened, but longer-term, possibilities involve the coupling of an ice-to-water conversion scheme with processes that can utilize the iceberg's prodigious capacity as an energy sink. For instance, an iceberg with a volume of one cubic kilometer has a mass of about 9×10^{11} kilograms, which would represent a total of 30 megajoules of energy in a 0° environment. If converted to conventional electric power with an efficiency of 3 per cent, we obtain 2.4×10^9 kilowatt hours which, if valued at 2.5 cents per kilowatt hour, would have a value of \$60 million. (More detailed discussions on coupling an ocean thermal energy conversion scheme with an iceberg water operation are found in papers presented by Heizer and by Roberts at the Iowa Symposium.) An important aspect of such a combined operation is that many of its profits and advantages are largely free — we need to melt the ice anyway.

Does exploitation of icebergs pose any legal or environmental problems?

The legal aspects appear to fall largely under the Law of the Sea Treaty, inasmuch as the present Antarctic Treaty omits reference to mineral exploitation (thereby implicitly excluding the consideration of icebergs). Besides, most iceberg pick-up sites would be north of the area considered by the Antarctic Treaty.

Current considerations of legal problems (discussed at the Iowa Symposium) find them to be tractable within established international procedures, and anticipation of legal problems can readily lead to strategies to facilitate their solution (for instance, avoiding harvesting or towing of icebergs within the 200-mile limit of a coastal state, unless there is a clear agreement with the state permitting such an action).

On the Antarctic continent itself there are no environmental effects. Even considering only the icebergs released into the sea in one year, a truly heroic towing effort would be required to move 1 per cent of one year's production. Inasmuch as the best candidates for towing have already escaped from the zone of pack ice to more northerly latitudes, the life-span of these icebergs is changed only slightly and their loss would hardly be noticed. During transit, an unprotected iceberg would produce a low salinity plume of cooled sea water and air, but presumably this would diffuse rapidly.

At the destination, a moored iceberg would definitely have the potential to affect its local environment, mainly by cooling the surrounding sea and air. The magnitude of these effects would be controlled largely by the processing techniques, but the production of local fog and condensation appears to be a strong possibility. At many of the potential delivery sites the effects of such local cooling could well be considered an improvement (and possibly an attraction). Potentially, the largest adverse effect would be on the local sea life, but if the iceberg were encapsulated in order to capture the fresh meltwater, these effects would be lessened.

What's next?

The possibility of iceberg utilization has stimulated considerable interest in what was an almost totally neglected aspect of polar oceanography. This interest is likely to continue until the idea either becomes an operational reality or is finally laid to rest. Currently, attention is being given to iceberg drift tracks and histories via the use of satellite imagery; arrangements are being made for field teams to visit and make measurements on icebergs located far north in the southern ocean; and experiments are underway to study the details of the iceberg melting process and of the physics of iceberg tows.

As individuals interested in the geophysics of snow and ice, we are understandably pleased by all of this activity. However, we would like to emphasize that even if geophysical factors are favorable, engineering procedures for processing and docking must also be made feasible, and the system's overall economics must be competitive. These areas of the problem have hardly been explored.

Certainly there are enough challenges to keep geophysicists, engineers, economists, and businesspeople occupied for some time. Yet the utilization of icebergs as a fresh water and energy source

— at favorable sites in the Southern Hemisphere — appears to be a promising, if elusive, possibility.

Where does this leave Prince Faisal and the arid reaches of Saudia Arabia?

Still rather dry, we would guess. Although Saudi Arabia may not be the hardest place in the world to deliver an iceberg, it can't be too far from it. Prince Faisal was well aware of these difficulties when he first became interested in iceberg water. But the scope of his interests in such a scheme appear to be global, with Saudi Arabia viewed as the ultimate, but not essential, pay-off.

We note that the interests of the Prince, as reflected in the activities of "Icebergs for the Future," a nonprofit organization which he supports, have shifted, for the short-term, toward test tows to Australia. Certainly this is a realistic move, in that it is prudent to try a high-risk venture at a site where it is most likely to succeed and can be carried out at the smallest (and most inexpensive) possible scale.

Thus far, he has spent only a small amount of money (by princely standards) on iceberg water. For this expenditure he has stirred up a great amount of technical interest, received considerable publicity, and been given large amounts of advice. Not at all bad for openers! Whether the Prince will eventually succeed in his ultimate purpose will only be revealed by passing of the sands of time, something he must understand very well.

For Further Reading

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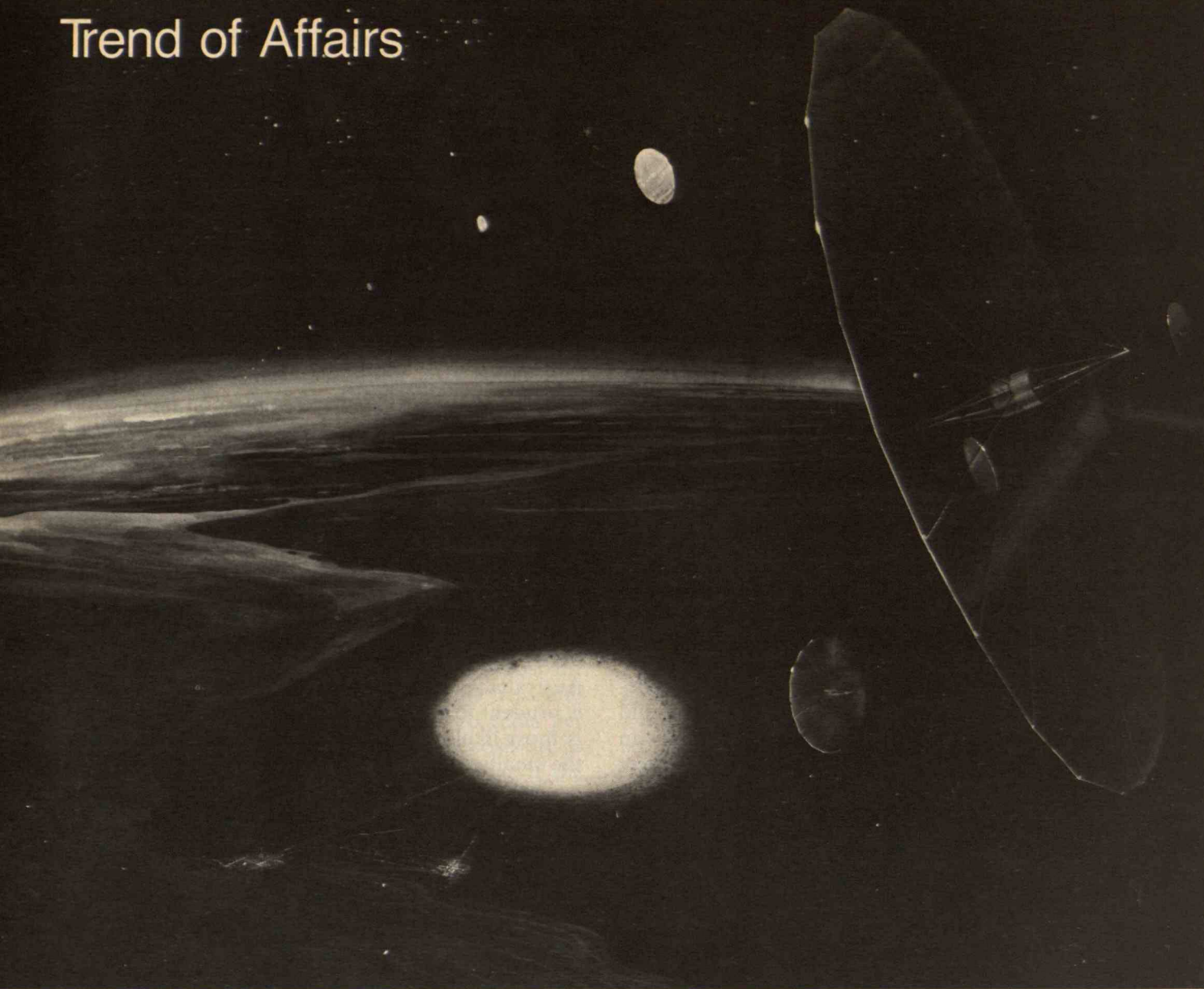
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W. F. Weeks and Malcolm Mellor spend their time (at the Cold Regions Research and Engineering Laboratory, in Hanover, New Hampshire) worrying about the scientific and engineering problems of the polar regions. Weeks, who holds a Ph.D. in geochemistry from the University of Chicago, has been president of the International Glaciological Society, chairman of the U.S. Committee on Glaciology, and visiting professor at the Hokkaido University Institute of Low Temperature Science and at the U.S. Naval Postgraduate School. Mellor holds a D.Sc. from Melbourne University and a Ph.D. in engineering from Sheffield University. He is secretary of the International Commission on Snow and Ice and editor of the journal *Cold Regions Science and Technology*.

Trend of Affairs



Trends This Month

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Artist's conceptualization of the Solares system of orbiting mirror satellites. Each mirror (top) reflects sunlight onto collection sites on earth (bottom), potentially even those normally in the darkness of night. Conversion sites on earth 10 kilometers in diameter could produce 11 gigawatts of electrical power, according to Kenneth W. Billman of N.A.S.A. The largest mirrors could be 10 kilometers in diameter. (N.A.S.A. Ames Research Center)

Energy

Off the Wall and Into Orbit

Will Skylab's return to earth help recatalyze serious interest in space? There's been a lot of press lately about a revival of enthusiasm for spaceflight, featuring space heavyweights (like Skylab and Soyuz), middleweights (like Landsat), and long-shot contenders (like the Voyagers). Soviet Cosmos satellites have been reported to take occasional pot shots at each other — now there's spacey action with a flair for gamesmanship.

With the burgeoning energy crisis, it seems inevitable that a new breed of satellite will continue this trend — turning space to advantage as a site for collecting solar energy. Until recently the only contender proposed for such work has been a

solar-powered satellite (SPS) project that would convert sunlight to microwaves, which it would beam down to receivers on earth. But in a dazzling display of conceptual footwork, three imaginative scientists have sidestepped the worrisome "fricasee threat" of errant microwaves (although the veteran SPS proposal is still a serious challenger for funding).

Kenneth W. Billman and William P. Gilbreath of the National Aeronautics and Space Agency's Ames Research Center in Moffett Field, Calif., and colleague Stuart W. Bowen of Beam Engineering, Inc., in nearby Sunnyvale think they are on target with an entirely new concept in passive solar satellites.

Their brainchild is named Solares, a system of very large, very flat, low-density reflector satellites, which will reflect nearly continuous sunlight to a worldwide set of terrestrial conversion sites. In keeping with the spirit of energy conservation, the mirrors would coincidentally resemble huge, aluminized-mylar-coated bicycle wheels consisting of "an outer toroidal rim, a tapered mast (or hub), and guy wires (spokes) between these," they say. A marketing director's dream come true.

The scope of their concept is truly mind-boggling. They aim for no less than a system that "can nearly duplicate in output that of the existing world system of hydro, fossil, and nuclear electric power plants. To accomplish this, Solares reflector satellites would be up to 50 square kilometers each, but would weigh next to nothing — between 10 and 200 grams per square meter. In comparison a square meter of newsprint weighs about 45 grams; presumably funny papers run a bit more. It's enough to make Paul MacReady and the Gossamer Albatross contingent (the pedal-powered group that recently flew the English Channel) cry.

The ethereally light construction of Solares satellites would be far easier and cheaper to put into space than would weightier ones. And thinking ahead, reentry would be a lot easier on barn roofs, grazing kangaroos, and what-have-you if pieces of returning spacecraft didn't weigh as much as, say a Volkswagen bus or the sleeper on a Peterbilt semi-tractor.

Solares has other compelling advantages, say its designers, which include the following:

- A yearly average of 1.14 kilowatts of reflected sunlight per square meter ("typical high-noon desert intensity") on ground conversion sites, compared with the U.S. ambient average of about 0.25 kilowatts per square meter. That's a 4.6

factor boon to photovoltaic conversion, to solar heat collection, and to agriculture.

- A "significantly lower seasonal variation" in the sun's perceived brightness — only about ± 10 per cent annually, the scientists told the American Association for the Advancement of Science earlier this year. Is a North Dakota watermelon crop nearing the realm of possibility? Year-round bicycling and baseball in New England? But what about the winter sports industry? Would the night shift become a thing of the past?

- Reduction of energy storage requirements "typically by a factor of five," they say, reducing one important barrier standing in the way of baseload solar conversion plants. However, the reputation of the "Land of the Midnight Sun" is secure, as some "eclipsing of the mirrors by the Earth occurs around local midnight" at the collection sites.

- Insensitivity to cost overruns. "Even five-to-ten-fold increases in its cost will still allow Solares to be competitive to alternative coal, oil, and nuclear electric power sources."

Indeed, economics seems to be squarely in Solares' corner. Installed, it could produce electricity for only a little over three cents (1977) per kilowatt-hour, say its proposers. In comparison, the Electrical Power Research Institute cites a range of about four to seven cents (1977) per kilowatt-hour for coal, synthetic coal-derived oil, and nuclear generation.

However, the size of the total bill — \$1.173 trillion (1977) or \$90 billion annually (excluding interest) does give one pause to reflect on the "fiscal black-hole effect" of macroengineering projects in general. But Solares' champions point out that such a sum is not without precedent: "This value is less than yearly monies collected into the U.S. social security system; it represents about 20 per cent of the federal budget; it is roughly 5 per cent of the U.S. Gross National Product; it is only three times the estimated annual investment of the U.S. electrical power industry needed to just keep up with increases in the U.S. demand." And return on investment, they calculate, would be a healthy 15 per cent, based on gross annual revenues of \$262 billion (1977) expected with an electricity cost of 3.7 cents per kilowatt-hour.

Will this remarkable proposal win its bout with other solar-powered satellite schemes for federal interest and funding? At the last reckoning Solares — like its challengers — will either turn out to be a visionary star that is borne aloft, or one for whom the final bell tolls. — L.A.P. □

Why Solar Energy Is An Uphill Battle

Proponents of fossil and nuclear energy systems seem consistently contemptuous of the idea that the solar systems could be widely adopted and have significant impact in this century. Now a new study of why solar is being given such a hard time sheds some light on little-mentioned real problems — and possible solutions — that lie along the "soft" path.

One problem is simply the vast disparity in government support, says Arnold R. Wallenstein of the Northeast Solar Energy Center in Cambridge, Mass. Mr. Wallenstein reports that Battelle Northwest Laboratories have calculated the federal investment in research and development, production, marketing, and commercialization of nonsolar forms of energy, including fossil, hydro, and nuclear for the 30 years ending in 1977: the total was between \$123 and \$134 billion (1976 dollars). Only a "miniscule amount" was allocated during that period to similar work on solar energy, he says.

Moreover, nonsolar technologies continue to enjoy some "nonquantifiable incentives," he points out. For example, the nuclear industry need not foot heavy liability insurance costs: under the provisions of the Price-Anderson Act, assured public liability of that industry in the event of a nuclear accident is limited to \$560 million. Also, the energy industry, which causes immeasurable environmental insults even after it has complied with existing regulations, in general need not pay anything toward clean-up.

Nonsolar energy technologies historically have satisfied U.S. energy demand. That fact alone makes the promise of solar less convincing to federal funding agencies than solar advocates would like, says Mr. Wallenstein. He also admits that traditional, laissez-faire economics still favors traditional energy technologies; if solar is to compete successfully with established energy technologies, substantial subsidies for manufacturers and incentives for consumers are needed.

But solar has lots of things going for it: The Council on Environmental Quality calculates that by the year 2000 about 25 percent of the U.S. energy supply could come from solar energy sources; by 2020 that fraction could grow to 50 per cent. Some essential economic benefits would accrue from such a growing solar energy industry:

- Reduction of the current \$50 billion sum now spent on imported oil;

□ Reduction of the amount of capital needed to build large central generating plants (many solar applications are decentralized);

□ Creation of many new manufacturing, installation, and maintenance jobs. The Office of Technology Assessment estimates that solar energy construction requires 1.5 to 2.5 times more labor than does the construction of a conventional coal-fired generating plant of equal energy output. The California Energy Commission estimates that solar energy construction can provide from 25 to 50 more *permanent* jobs per trillion B.t.u.'s used per year than do oil, coal, or nuclear power.

But progress toward these goals will require "proper federal incentives" for the development and adoption of solar energy, Mr. Wallenstein says, fostered in an atmosphere of enlightened optimism. Such encouragement could take the form of tax credits, loans and other guarantees and technical assistance — a series of plans very much more modest than "the massive grants and R & D programs used to develop centralized energy technologies," he says.

The outlook for solar energy in the U.S.? For private investors it all comes down to the bottom line; public enthusiasm, and the promise of benefits to national economics, environmental quality, and even national security are not measured by return-on-investment criteria. Says Mr. Wallenstein: "... if Federal policies are not modified, then it ... will be a long time before solar and other alternate energy sources ... make a significant contribution to U.S. energy supplies." — *L.A.P.* □

Petroleum Paranoia? Ask the Economists

The U.S. has at least 390 billion tons of recoverable coal and most of the basic technology for converting this prodigious resource into gasoline, diesel fuel, heating oil, methane, chemical feedstocks, and all the other vital things for which we now depend on oil.

Why, then, the nation's paranoia about petroleum?

The answer is as near as the closest economist. It is no accident that we have become dependent on oil and natural gas and panic at the suggestion of their demise: they are our cheapest energy resources, and economists find bad news in all of our alternatives.

Consider the plight of the coal salesman

ready to deliver low-sulfur Wyoming coal to the manager of an industrial plant in Chicago who needs 100,000 pounds of steam per hour. To persuade this manager to convert his boiler from oil priced, for example, at \$20 per barrel, the salesman must offer his coal at between \$16 and \$36 per ton (depending on the type of conversion involved); but the present delivered price of Wyoming coal in the appropriate quantities is more than \$39 per ton. For high-sulfur Illinois coal the problem is even worse: the salesman must quote a price not higher than \$20 per ton (but the current price is over \$34).

These figures, and many others only a little less discouraging to those who would reduce oil imports through wider use of coal in U.S. industrial processing, come from T. D. Anderson and E. C. Fox at Oak Ridge National Laboratory.

As the size of the application goes up, coal becomes somewhat less prohibitive in price; indeed, the owner of a very large industrial plant (using at least 1 million tons of steam per hour) could save money today by converting to either Wyoming or Illinois coal.

But only 30 per cent of U.S. industry is of such size, and even these large industrial fuel consumers are sitting on their order books. A series of constraints and uncertainties explain management's reluctance to convert, say Messrs. Anderson and Fox:

□ Though the capital cost of conversion is included in the figures cited above, there is no way to evaluate the larger issue which is before every manager: which of all the alternatives for investing scarce capital will yield the greatest return?

□ Coal-burning equipment is comparatively long-lived; would-be investors commit themselves to continued operation of their plants at their present locations for perhaps 20 years if their investment is to be fully written off.

□ As regulated public carriers, railroads cannot contract for new equipment loans. So many coal customers will want the protection of owning their own fleets of coal cars — another capital investment problem.

□ Several technological uncertainties remain: Are fluidized-bed combustion systems (ready perhaps by 1985, when they may increase efficiency and decrease costs) worth waiting for? What about oil-coal mixtures? And new ways to clean stack gases of pollutants? And new environmental laws?

Turning to conversions in which coal is made into synthetic substitutes for gasoline and natural gas, the situation is far

more bleak. The five technologies most nearly developed for this purpose, says Saman Majd of the M.I.T. Energy Laboratory, "are not economically viable unless world oil prices rise dramatically in the next five or six years, and then only if the domestic price of oil is deregulated."

Dr. Majd's calculations are fraught with uncertainty, since large-scale use of these technologies is essentially unknown — and who knows what would be the price of coal when they're ready? But on the basis of a series of assumptions about the timing and cost of new technologies not yet tested at full scale, Mr. Majd identifies two processes for generating synthetic fuel from coal — which can show profitable operation if brought on line in 1987, if the world oil price reaches \$25 per barrel — a not unlikely possibility. *In-situ* production of shale oil would also return its investors a modest profit by 1987 under the same dreary assumption about the world crude price, says Dr. Majd. — *J.M.* □

Bridging the Solar- Terrestrial Gap

What happens on the sun some 93 million miles away to cause and shape the stream of particles which we call the solar wind is now fairly well understood. But the effect of the solar wind on the earth's outer atmosphere, only 65 miles away, remains largely a mystery. It's like reading an imperfect copy of an Agatha Christie novel, says Robert M. MacQueen of the National Center for Atmospheric Research in Boulder, Colo.: a gripping story gradually unwinds — until suddenly the final chapter is missing.

The gross effects of solar radiation are obvious enough: light and heat from the sun have transformed our planet from a cold, rocky lump into a rich, living environment. But details of the sun's effects on weather and climate remain to be explained. For example, do sunspot cycles correspond with changes in weather on earth? And what of the solar wind — the turbulent stream of charged particles that constantly streams into space from the sun's nuclear reactor? And the outpouring of radiation and particles from solar flares and the large events in the sun's corona we observe during eclipses?

It is the solar wind and its effects on the earth's atmosphere that most intrigues Dr. MacQueen. It's now possible to explain the fluctuations we observe in the solar wind on the basis of a consistent theory of

solar physics operating on the sun's rotation and variations in its magnetic field. But it is not at all obvious how variations in the solar wind as it strikes the earth's magnetosphere are reflected in our environment. The energies involved are clearly large enough to affect weather and climate. But the mechanisms — and even the correlations — are by no means clear, and finding the answers will be "a leading area of scientific research over the next several decades," Dr. MacQueen told members of the M.I.T. Club of Boston at their annual meeting late last fall. — J.M. □

Health

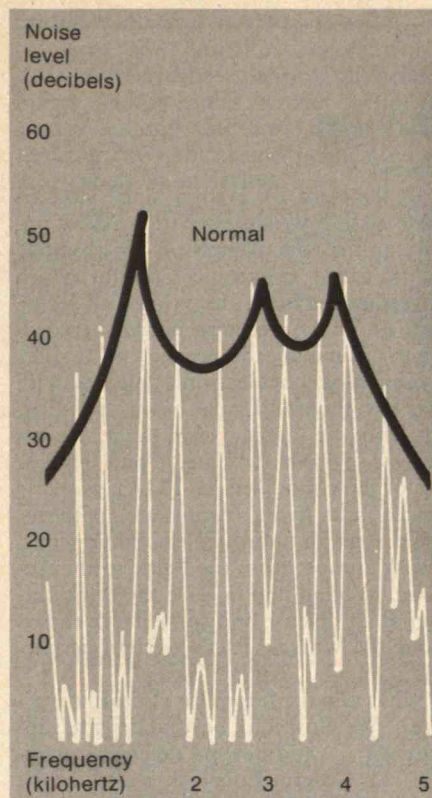
Babies' Cries Give Clues to Diseases

When I was a young mother, the pediatrician assured me that the long, loud, crystal-shattering sounds coming from my newborn infant indicated his good health. He has strong, vigorous lungs, the doctor explained; baby had his acoustics down pat and a good physical structure to back him up.

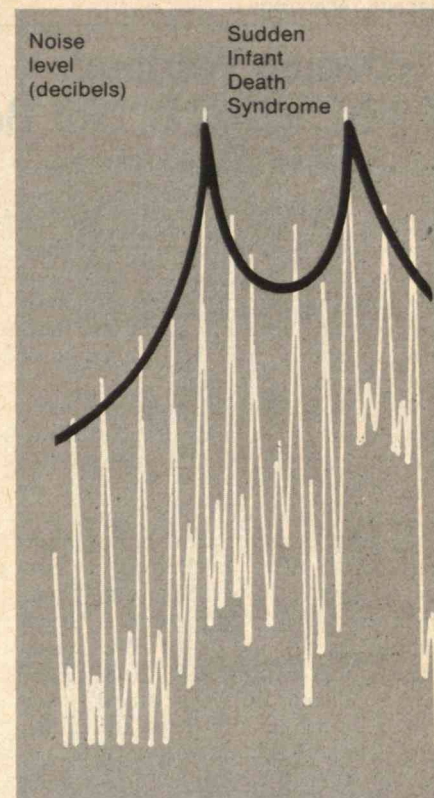
Such diagnostic statements about babies' cries signaling good health — or illness — have a great deal of truth in them, according to current research by Howard L. Golub and Kenneth N. Stevens of M.I.T.'s Research Laboratory of Electronics and Department of Electrical Engineering and Computer Science. Although scientists in this country and abroad have tried for 20 years to relate cry profiles to infant ailments, his recent tests with a computer cry model showed surprisingly accurate results.

Mr. Golub developed the model by using the accepted acoustic theory of adult speech production and modifying it to fit babies. Since adults and children differ in anatomical proportion, ratios like pharynx length to mouth length, nasal tract length to vocal tract length, and central nervous system disparities had to be adjusted accordingly. Then, using the tape-recorded protests of 55 apparently healthy newborns during a blood test (called the P.K.U. heel stick), Mr. Golub subdivided the cries into 88 variables, such as pitch, intensity, fundamental frequencies, and resonances.

He then used a computer to compare healthy babies with those of 43 babies having known or suspected health abnormalities. Recordings of these latter cries were supplied by Dr. Michael Corwin, resident in pediatrics at the Upstate



The chart at the left shows the short-time (25 milliseconds) spectrum of mid-portion of the cry of a normal infant. The chart at the right plots the short-time (25 milliseconds) spectrum of mid-portion of the cry of an infant that later died of sudden



infant death syndrome. Notice the very high first resonance and large amount of noise at the high end of the spectrum, possibly indicating a constriction of the vocal tract near the pharynx.

Medical Center, Syracuse, N.Y. Of these 43 cases Mr. Golub's computer analysis located 19 of 21 infants with severe jaundice and nine of ten babies suffering from respiratory difficulties. Fifteen healthy babies from Dr. Corwin's group were also correctly identified from their cries alone.

Mr. Golub's research team found that a specific ailment is associated with a characteristic cry pattern. Assuming that most infant pathologies alter the acoustically relevant structures, it follows that some aspects of the cry will be correspondingly changed, Mr. Golub explains. For example, if the infant has respiratory distress one would expect a shorter cry due to a change in the dynamics of respiratory muscles responsible for oxygen intake, or a change in vocal tract resonances resulting from a constriction of the pharynx — a possible explanation for the tragic sudden infant death syndrome. In such a case one might also expect a higher frequency sound since the vocal tract acts much like a pipe organ acoustically — a

narrow or squeezed pipe giving a higher frequency sound. Another abnormal indicator, a time delay between the stimulus such as a heel prick and the onset of the cry, could be an early signal of brain damage, he said.

As a sidelight of his research on jaundice cases, Mr. Golub discovered that some levels of bilirubin — a by-product of the breakdown of hemoglobin — previously believed "safe" are likely harmful. Early treatment for such a condition could prevent brain damage. Other abnormalities likely detectable with the model include bacterial meningitis and maybe deafness.

Initial tests suggest the accuracy of Mr. Golub's model is very high, but many more babies must be recorded and one specific disorder followed in detail before the technique could be a mass screening device, he says. To continue their research he, Professor Stevens, and Dr. Corwin hope for a grant from the National Institutes of Health. — S.K. □

Electronic Warfare: When Seeing Is Not Believing

It used to be that tactical military aircraft were evaluated in terms of flyability and firepower. Today's military jet set still speak of ever more awesome speed, range, rate of climb, and ordnance — and also in new acronymical terms of a revolutionary breed of bird with EW (electronic warfare) capability and ECM (electronic countermeasures) potential.

New EW equipment is so potent that it may defuse certain kinds of tactical warfare. For example, the ultra-sophisticated \$12 million (1978) EF-111A made by Grumman Aerospace Corp. "could turn out to be a decisive factor in helping to deter 'short wars' in Europe or elsewhere," says A. Robert Salzmann, Director of Advanced EW Programs at Grumman. Edgar Ulsamer of *Air Force* magazine describes the EF-111A "Electric Fox" as a "supersonic electronic shield" capable of blinding the eyes of radar-dependent anti-aircraft weaponry, including anti-aircraft artillery, surface-to-air missiles, and interceptor aircraft.

And they can't hit what they can't see. Thus, to a tactician, radar-jamming power is extremely desirable. But heavily armed tactical strike aircraft can't themselves carry "enough electronic countermeasures gear — or the required electric power — to jam the growing number and variety of hostile radars," says Mr. Ulsamer; therefore the need expressed by the Air Force several years ago for a "dedicated airborne tactical jamming system."

This need was satisfied by three tons of equipment — antennas and computer modules — hooked up to the ALQ-99E advanced radar jammer made by Cutler-Hammer, Inc., of Deer Park, N.Y., and mounted in Grumman's Mach-2, swing-wing F-111 airframe. Specific details about the inner workings of the ALQ-99E are classified, but it is generally known that this EW system "transmits many hundreds of kilowatts of radio frequency power," says Mr. Ulsamer — enough power to completely mask the movement of friendly strike aircraft from hostile radar detectors.

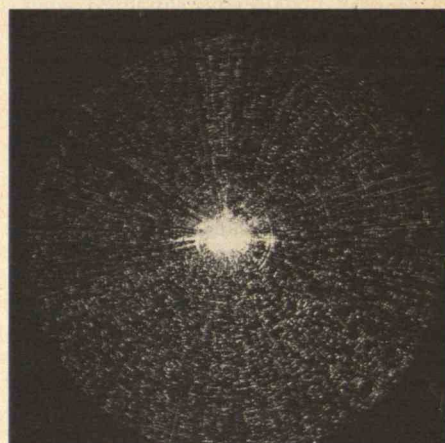
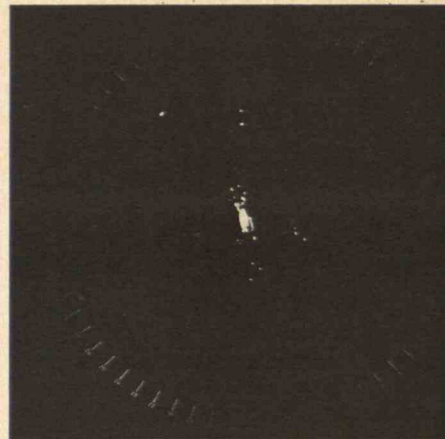
Following successful prototype testing, the Defense Department authorized Grumman to produce six EF-111As for the U.S. Air Force. Grumman itself envisions the possible modification of 42 non-EW F-111s into EF-111As at a total cost of about \$900 million (including

spares).

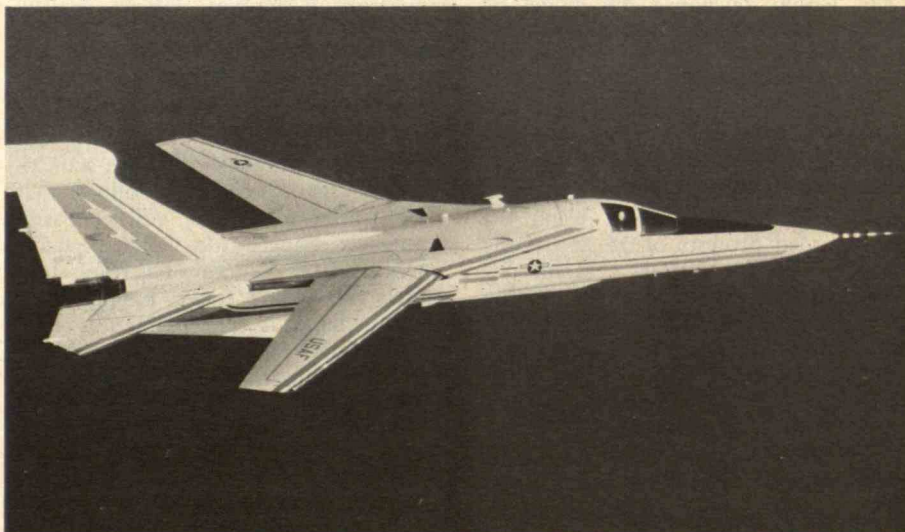
Deployment of even a small fleet of these aircraft would have tremendous impact on the effectiveness of, for example, the so-called Electronic Curtain, which hovers unseen but — for now — all-seeing over N.A.T.O.'s eastern border. According to Grumman, this area is the "world's densest thicket of electronic defenses, with over two thousand radar beams 'painting' any airborne target within range. Nevertheless, says Mr. Ulsamer, "only four or five of these modified EF-111As, properly spaced and flying 'race-track' patterns, could erect an unbroken electronic screen across Europe, from the Baltic to the Adriatic, to blind and deceive the thick curtain of air defense and surveillance radars along the Warsaw Pact's western perimeter."

What is in the future for electronic warfare? "We must look beyond defense suppression . . . and beyond defensive thinking," Lt. General Robert T. Marsh of the Air Force Systems Command told the Annual Joint Electronic Warfare Planning Conference at Eglin Air Force Base in May. General Marsh described the ultimate potential of electronic warfare devices: "to destroy, degrade, deceive, or exploit the enemy's command and control . . . his signal intelligence, his command centers, his data links, his tactical air control system, his artillery, armor, and other communication nets. . . ."

And not a shot need be fired: a very different kind of war. — L.A.P. □



A normal radar screen (top) shows several possible targets which disappear in a storm of jamming signals (directly above) generated from the EF-111A electronic countermeasures aircraft (below) being made by Grumman Aerospace Corp. for the U.S. Air Force. (Radar photos: Cutler-Hammer Corp.; EF-111A: Grumman Aerospace Corp.)



The Horror of Nuclear War Reexamined

"Enjoy the fine art of being terrified," said the poster. "Witness an unprecedented series of modern portraits of terror and masterpieces of the macabre." A Boston museum was recently announcing its summer program of films — scary ones, in keeping with the current fashion — but these words could well have described another set of locally-oriented "events." Boston was being hypothetically blasted back into the Stone Age by three independent studies on nuclear war and its effects.

One hundred years ago General William Tecumseh Sherman acknowledged that "war is hell." But to read Kevin N. Lewis' "The Prompt and Delayed Effects of Nuclear War" (*Scientific American*, July 1979) is to see that a 19th century metaphor might well be a literal description of what modern conflict and its aftermath could be. Mr. Lewis, a fellow of the Arms Control Project at the M.I.T. Center for International Studies, asserts that previous models for thinking about the unthinkable — "formal methodologies of assured-destruction scenarios" — have excluded "some of the most profound and long-lasting effects."

Nuclear blasts in the Boston area would promptly kill some 1.3 million people. Grisly enough, but "analysis" can go a lot further. The effects of radioactive fallout, for example, are excluded from traditional calculations, but in the aftermath of a Boston attack they could cause about 500,000 fatalities. Casualties from fires would contribute another 500,000 to the total. In fact, Mr. Lewis suggests that for "a typical urban target" like Boston "the most devastating effect might be incendiary." Each burst from a one-megaton atomic bomb — ten of them are targeted for Boston in Lewis' detailed scenario — could ignite fires as far as ten miles away. "Flash-induced fires would be joined by blast-triggered fires" (from toppled furnaces and automobiles, for example). Most fires would spread uncontrolled because "water mains would be shattered and firefighting equipment and crews would be destroyed and disabled." Individual fires might consolidate into firestorms (driven by strong vertical updrafts) or conflagrations (fanned by persistent ground winds), generating temperatures in excess of 1,000° C — enough to burn or melt most "fireproof" materials. The result: "total devastation within

the affected area," says Mr. Lewis.

Injured and burned survivors would suffer untreated because most physicians, nurses and hospitals would no longer exist. Food and shelter would be scarce. And the city's social and political structures would be in disarray.

Previous studies "do not give a complete picture of the potential vulnerabilities and strengths of complex urban societies," according to a second report, "Economic and Social Consequences of Nuclear Attacks on the United States" (*Congressional Joint Committee on Defense Production*, March 1979). Dr. Arthur Katz, of the U.S. Department of Energy, wrote the report based on his earlier work at the M.I.T. Laboratory for Nuclear Science. Past attempts at analysis were typically based on "crude physical measures of destruction," he said, and tended to ignore the "interactive effects" of our social and economic systems.

Dr. Katz analyzed the effects of four hypothetical nuclear attacks on the U.S. (with detailed observations on the regional effects in Massachusetts). He estimated the effects on production capacity, fuel, labor, and food as well as political, social, and psychological impacts.

Dr. Katz assumed that 17 one-megaton weapons would be detonated in the Boston area; three in the Worcester and Fitchburg areas; and three in Springfield. New Bedford and Pittsfield appear to get relatively light treatment, being "subject to attacks by hundred-kiloton weapons" (recall that the damage to Hiroshima was accomplished by one 16-kiloton bomb). His understated conclusion: "Massachusetts is clearly severely damaged:"

□ 1.4 million fatalities and one million injuries in the Boston area — "conservative for multiple-weapon attacks," he said. The core of Boston would be destroyed and with it the governmental-medical-academic complex that is an important ingredient in the economic vitality of the region."

□ Decimation of all manufacturing capacity.

□ Cut-off of food supplies. About 85 per cent of Boston's food comes from other parts of the country and more than 90 per cent of the local food-processing industry would be destroyed.

□ Loss of power. Ironically, "basic generating capacity and the system for coordinating [the region's electric] power grid are likely to be adequate in the post-attack period," according to Dr. Katz. But such survivability would be nullified. New England relies heavily on imported petroleum for its energy needs,

A description of how the nuclear holocaust came to pass (as inscribed, centuries later, by a fictional religious order):

It was said that God, in order to test mankind which had become swelled with pride as in the time of Noah, had commanded the wise men of that age, among them the Blessed Leibowitz, to devise great engines of war such as had never before been upon the earth, weapons of such might that they contained the very fires of Hell, and that God had suffered these magi to place the weapons in the hands of princes, and to say to each prince: "Only because the enemies have such a thing have we devised this for thee, in order that they may know that thou hast it also, and fear to strike. See to it, m'Lord, that thou fearest them as much as they shall now fear thee, that none may unleash this dread thing which we have wrought."

But the princes, putting the words of their wise men to naught, thought each to himself: If I but strike quickly enough, and in secret, I shall destroy those others in their sleep, and there will be none to fight back; the earth shall be mine.

Such was the folly of the princes, and there followed the Flame Deluge.

Excerpt from A Cantic for Leibowitz, by Walter M. Miller, Jr.

which would be unavailable. Spare parts, maintenance services, and other required skills would be extremely limited, and transmission lines would be down.

□ Devastation of Harvard, M.I.T., Tufts, and many other educational institutions. Said Dr. Katz: "Even the smallest attack will seriously, perhaps irreparably, degrade the higher education system in Massachusetts." And, a not unlikely corollary, "many complex experiments which required extraordinary collaboration among scientific groups, and expensive and sophisticated equipment, may be delayed for very long periods."

"Significant economic disruption and social disorganization could be achieved even with the smaller attacks," concludes Dr. Katz. Indeed, a nuclear war "could reduce the survivors to a medieval economy," says a third report from Congress's Office of Technology Assessment (May, 1979).

What is the point of this current spate of doomsday studies? After all, the megadeaths-versus-megadollars mentality has been around for decades. It is to remind decision-makers that in a modern, technologically based society the indirect, subtle, long-term, and cumulative effects of nuclear war may well be the most damaging of all. Such effects generally elude quantification and tend not to appear in formal analyses. Thus reports of society's death (with apologies to Mark Twain) have been greatly underestimated.

Mr. Lewis has cautionary words for any would-be hawks either here or in the Soviet Union. Neither side "needs to be concerned about the integrity of its retaliatory capability," he says. When the full effects of even a relatively "eroded" counter-attack are considered, they are "so catastrophic that they render any notion of 'victory' meaningless." *S.J.M.* □

Particle Beam Weapons?

The U.S. — and probably the U.S.S.R. — are studying "particle beam weapons" reminiscent of the "electron guns" used in Buck Rogers movies. A report from the M.I.T. Program in Science and Technology for International Security (P.S.T.I.S.) sets low prospects for the success of such ordnance, basing its conclusion mainly on three points:

- The generation of particle beams capable of damaging military targets would require immense power;
- Extremely accurate aiming would be required — and difficult to achieve;
- Countermeasures would be relatively easy to mount.

Movie props are one thing, and operating weapons systems quite another. The generation of powerful beams of subatomic particles isn't a simple process, and problems abound.

Any particle beam has one special disadvantage compared with explosive weapons: the beam must hit the target. An explosive need only be detonated nearby.

In space, a beam of particles of like charge — electrons or protons — would quickly disperse because of the mutual repulsion of the particles, and would also be subject to deflection by the earth's magnetic field. This dispersion and deflection would greatly complicate the process of taking aim. In the atmosphere, a charged-particle beam would maintain its integrity because of its ionization of the gases around it; but the process of ioniza-

tion would drain the beam's energy, dropping the effective range to perhaps less than one kilometer, according to the report.

What about neutral particles? "No physical laws exclude the possibility" of their use in outer space, says the P.S.T.I.S. report. But there is doubt that such a beam — with sufficient energy to destroy a missile or spacecraft — could be reliably generated and aimed to a range of even one kilometer. And there is no obvious way for the user of such a neutral beam weapon to see where the beam is going and so to correct aim and turn a miss into a hit.

A host of countermeasures are possible, according to the report. Target missiles could send out multiple decoys, use an "ahead-fired smoke rocket" to impair optical tracking systems, and release chaff to counter radar guidance or even small explosive rockets to disturb the air — and possibly the beam itself.

In sum, conclude the four authors of the P.S.T.I.S. report — Professor George Bekkefi, Professor Bernard T. Feld, John Parmentola, and Kosta Tsipis — the prospects of achieving a useful particle-beam weapon are "vanishingly small. It is . . . highly questionable whether such a weapons system can function at all." — *J.M.* □

Last Line

Democracy, Nuclear Waste, and a Modest Proposal

"To the village square," said Albert Einstein, "we must carry the facts of atomic energy. . . . From there must come America's voice."

The democratic process is cherished by most Americans. An issue may be complex, and its requisite public education and debate may be time-consuming and frustrating to all concerned, but that is the price — willingly paid — for a "government of the people, by the people, for the people."

Yet there are other points of view, especially when investments are already in place and time is short. As Vito Corleone (fictional "Godfather" of New York's underworld) was fond of saying, "make 'em an offer they can't refuse."

The disposal of radioactive wastes is considered by many informed observers to be the most technically uncertain and

politically obscure among all problems in the nuclear arena. Alan Jakimo and Irvin C. Bupp (of the Harvard Graduate School of Business Administration), for example, caution against "designing and building a nuclear waste repository before there exists a broad and explicit consensus." (See "Nuclear Waste Disposal: Not in My Backyard," *March/April*, 1978, p. 64.) Even a presidentially-appointed committee of experts — the Interagency Review Group headed by John M. Deutch, undersecretary of the U.S. Department of Energy (D.O.E.) — could come up with no firm answers, and recently deferred to the people: "A societal judgment that considers the level of risk and the associated uncertainty will be necessary," they said.

But the "societal judgment" that appears to be shaping up is less than unanimously enthusiastic. California, Wisconsin, Maine, and Iowa have banned new reactor projects pending federal approval of waste disposal methods. Eight states have legislatively declared themselves off-limits to permanent nuclear repositories; and some communities — New York City, New London (Conn.) and one-fifth of the towns in Vermont, for example — have prohibited the transport of such wastes within their borders.

Is it any wonder that some nuclear advocates have begun abandoning Einstein for the refreshingly simple and direct approach of Don Corleone? They clean up the language, of course — one former director of a state energy office proposed to the D.O.E. last year that it "develop a compensatory incentive for the states or regions who may serve as potential hosts for a nuclear waste disposal site."

Such a message was recently carried to the halls of Congress by Professor Michael O'Hare of the M.I.T. Department of Urban Studies and Planning. Testifying before the House Committee on Interior and Insular Affairs during its June hearing on "Public Participation and Equity in Nuclear Waste Facility Siting," Professor O'Hare told the committee members how previous strategies, in his view, had failed. "Citizen participation simply means amplifying the political power of groups whose only rational position is uncompromising opposition," he said, and "informing the parties to this debate in greater detail about the consequences of the project being proposed will simply confirm and sharpen their perception that it is really much worse for them than the status quo."

If citizen participation and public education are inoperable, what then? In the

words of Professor O'Hare: "I recommend accordingly that nuclear waste processing and storage facility plans include explicit compensation for the individuals who can expect to be injured by it, including such intangible injuries as anxiety." This, he assured the committee, "will make it possible to proceed with whatever technical solution to the nuclear waste problem is chosen."

Is quality of life or "amenity of the community" merely another input to the production/construction process? According to Professor O'Hare, "You should no more expect to use that amenity . . . without paying for it than you should expect to obtain steel or labor for free." But does this conveniently one-dimensional model explain why people oppose nuclear and other risk-producing industries? In his view, it does. "The opposition to facilities of this kind," said O'Hare, "comes from neighbors who expect to have their quality of life taken away from them without being paid for it." And a happily compensated neighborhood "makes it more difficult for geographically diffuse opposition groups to form effective coalitions with locals." He suggested that "what we should be aiming for, is a sort of competitive market of communities attempting to under-bid each other."

Professor O'Hare's plan raises some basic ethical questions: What is the dollar value of a life, or of good health, or of psychological well-being? Who would compute these "socially optimal" pay-offs? How do you compensate future generations, and where do you draw the geographic line? What sort of injuries, illnesses, or defects would be "covered," and could they be amply compensated?

Similar schemes have been proposed before in other areas of "environmental impact" — in air and water pollution control, for example. In those situations, the analyst's general reasoning is that paying an "effluent charge" provides a non-regulatory, economic incentive for polluters to reduce their pollutant emissions. In this case, however, the amount of pollutant is constant, and the operator's only incentive is to make the needed "purchases" at the lowest possible rates.

The success of such a plan obviously relies on the key assumption that the majority of dissenters can be satisfied, or at least silenced, for a price. But is there really enough money to do this? And, more importantly, would legitimate, deep-seated concerns be abandoned for a fast buck? S.J.M. □

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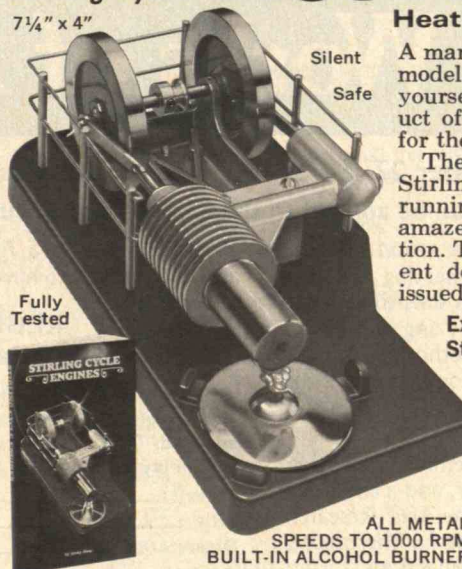
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Eric J. Chaisson: (The Scenario of) Cosmic Evolution. Harvard Magazine, Nov/Dec 1977

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| D. Coutts | Q. Introit |
| E. Cormorant | R. Cymbeline |
| F. Hoity Toity | S. Eutheria |
| G. Aegyptische Helena | T. Virtue |
| H. Interstitially | U. Orff |
| I. Strapless Evening Gown | V. Laminar Flow |
| J. Shiftless | W. Ultime Fauchelevent |
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Scientific Examination of Works of Art

October 27-28, 1979 Cambridge, Massachusetts

Learn how technology can be applied to the analysis and documentation of works of art.

Sponsored by *Technology & Conservation* and the M.I.T. Historical Collections, this meeting will provide a broad overview of the various scientific instruments and techniques useful in analyzing an object's composition and characteristics — methods which can help in understanding, dating, and/or authenticating paintings, ceramics, metallic artifacts, and other works of art.

Fee: \$50 — includes registration, seminar materials, two luncheons, reception-social hour, and a choice of a tour of the Boston Museum of Fine Arts' Research Laboratory, the M.I.T. Scanning Electron Microscopy facility, or the M.I.T. Historical Collections.

Featured Lecturers: — include Dr. Edward V. Sayre, Boston Museum of Fine Arts' Research Laboratory and Brookhaven National Laboratory; Dr. Lambertus Van Zelst, Boston Museum of Fine Arts' Research Laboratory; and Prof. Robert Ogilvie, M.I.T.'s Materials Science and Engineering Department. William J. Young, Emeritus Head, Boston Museum of Fine Arts' Research Laboratory will serve as moderator and featured speaker.

Registration is on a first-come, first-served basis. (Registrants are *not* required to have a chemistry background.) Fee is tax deductible.*

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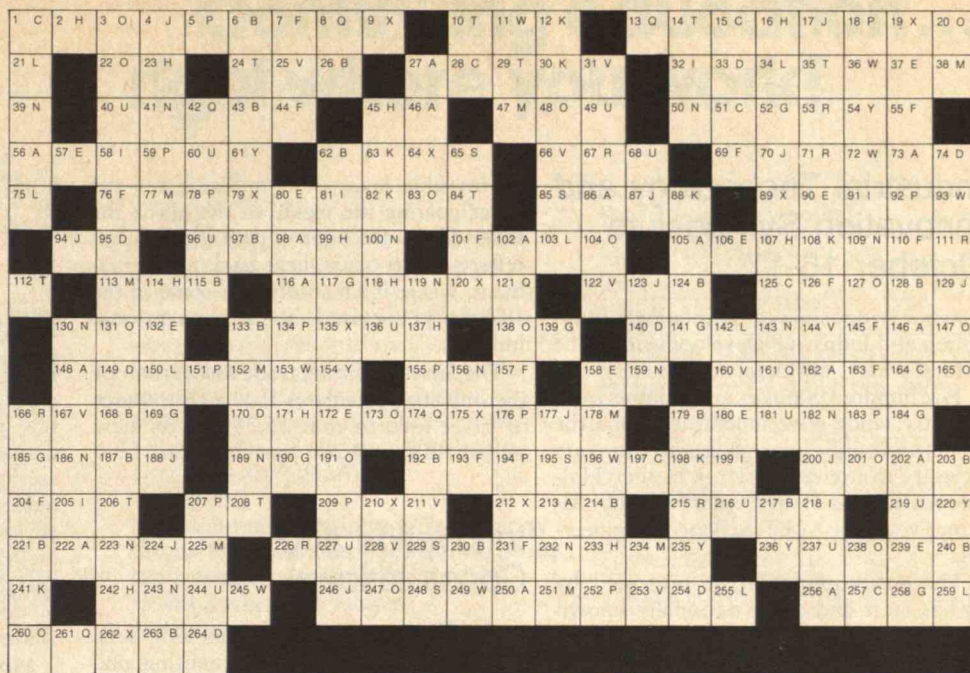
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A Fantasy in Outer Space



Complete the word definitions; then enter the appropriate letters in the diagram to complete a quotation from an article on cosmology. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; if there is no black square at

the right end of the diagram, the word continues on the next line.

A solution to this Tech-Croctic will be given in the next issue of the Review, when another of Mr. Forsberg's puzzles will also appear. Readers are invited to comment — and to suggest favorite texts for future puzzles.

A. Late Pliocene hominid, small-brained but erect
202 213 27 105 98 56 146 86 222
73 250 102 256 116 148 46 162

B. "Miss ___" (3 words) (O. Nash, "Private Dining Room")
192 168 203 145 240 179 263 230 6
133 97 217 187 43 221 128 26 214
124 115 62

C. Asymmetrical
257 28 15 1 197 125 51 164

D. _____ the Great, second Viceroy of Portuguese India, (1453-1515)
33 140 95 149 254 170 74

E. Affliction of the joints and muscles
57 106 180 239 80 158 37 90 132
172

F. English town on the Stour
76 7 110 44 231 193 69 204 55
157 101 163 126

G. "_____ Path", Buddhist ethical doctrine
185 141 52 190 169 139 117 258 184

H. Russian cellist, conductor, accompanist
107 2 137 242 118 171 16 23 233
45 99 114

I. South Dakota town on the Cheyenne
218 264 199 81 32 58 91 205

J. Mediaeval single-stringed instrument (Ger.)
224 94 87 188 4 123 246 129 70
200 17

K. Autonomous Soviet Republic on the Caspian
241 63 88 108 12 82 30 198

L. Attractive
142 75 34 103 21 259 150 255

M. Intellectual, moral, cultural state of an era (Ger.)
152 251 77 113 225 234 38 178 47

N. She sang the title role in Peri's "Euridice", Oct. 6, 1600 (Full name)
186 223 159 189 119 143 182 109 156
50 39 243 41 232 100 130

O. Family of ribbon worms
238 104 138 131 147 260 48 247 127
20 173 3 83 201 22 191 165

P. System of inheritance by the youngest son
194 78 5 151 176 207 155 92 18
134 209 59 252 183

Q. He introduced the telephone into Germany, 1877
261 174 42 161 13 121 8

R. British pioneer in jet propulsion, 1907-
215 67 53 226 166 71 111

S. A religion (lit. "Submission to God's will")
248 195 85 65 229

T. Original name of Montgomery, Wales
24 84 177 208 14 29 112 10 206
35

U. Spicy Swabian comestible
227 244 219 68 60 136 181 216 40
96 49 237

V. "_____ Bahn", Railway through the Engadine Valley
31 167 122 211 66 253 160 144 25
228

W. Contenders in trials of speed, agility, strength
11 249 196 72 36 245 153 93

X. Greek city associated with Byron
64 175 135 212 262 89 79 120 9
210 19

Y. One of the cities assigned to the Children of Judah (Josh. XV)
236 235 220 61 54 154

Industrial Technology and Innovation Symposium October 16-17

A major symposium on Technology, Innovation and Industrial Development will be held at M.I.T. on October 16-17.

Five hundred planners and analysts from industry, labor, government, academia, the media and public interest organizations are expected to attend, says Dr. J. Herbert Hollomon, director of the Center for Policy Alternatives at the M.I.T. School of Engineering.

The symposium will be presented by M.I.T. staff and other nationally known experts who will present their insights on how the process of innovation works and on what must be done by the government and by the private sector if the U.S. is to maintain a healthy rate of technological innovation.

Silver Linings for Light Bulbs

A new energy-efficient light bulb based on work by John Fan and Frank Bachner of Lincoln Laboratory — 30 watts of power gives the same light as provided by a conventional 75-watt bulb — is now being developed for commercial production.

The incandescent filament in a light bulb emits 90 per cent heat and 10 per cent light. The new low-energy bulb has

an invisible layer — 2 milligrams — of silver coating the inside of the glass; the silver allows the light to pass through but reflects much of the heat back to the filament, where it substitutes for some of the electricity required by a conventional bulb.

The Silver Institute, trade association of the industry, calculates that a troy ounce of silver used to coat 15,550 of the new bulbs will save 1,220 barrels of oil. □

Innovation and Construction

The construction industry has long been considered backward in promoting and adopting technological innovation. Not so, says Francis T. Ventre, chief of the Environmental Research Division at the National Bureau of Standards.

Dr. Ventre admits that some observers find his point a hard one to accept. The significance of changes in construction technology — and even the fact of those changes — “have continually eluded economists and students of industrial productivity,” he said in a paper prepared for a workshop in technology and public policy at M.I.T. early this year. But that’s because such analysts “assess the house-building industry with measures and indices developed for more stable, more conventionally deployed industries.”

The construction industry is different, and it is in responding to precisely those differences that the industry earns its points in Dr. Ventre’s analysis — responses that are “the very genius of the adaptive construction industry,” said Dr. Ventre. These qualities are its small size, its primary reliance on manual skills, and its high entry-exit rate.

For example, analysts of the construction industry have said that it is undercapitalized. But Dr. Ventre pointed out that construction activity fluctuates so greatly from season to season and year to year that “building contractors and homebuilders would be foolish to own and maintain expensive fixed equipment. Construction management places more emphasis, therefore, on financial capital and on a well-paid, highly skilled, enormously mobile, flexible work force.” This makes sense for the construction industry which is “distributed across the nation, as the population is distributed, the better to serve local need,” and whose “work moves from site to site and job to job.”

“The (building) industry must be interpreted *sui generis* and not as a deviant

from conventional industrial practice,” Dr. Ventre concludes. — *Steven Frann*, '80 □

Watching Proteins at Work

It’s always been assumed that the thousands of atoms in protein molecules are held rigidly in place. But a new technique of low-temperature crystallography devised by Professor Gregory A. Petsko in the M.I.T. chemistry department suggests that this assumption may be wrong — and in doing so the technique may open a whole new way to study protein nutrition.

Most protein reactions occur very quickly; pepsin — an enzyme in the stomach — helps chew up other protein molecules at the rate of about 1,000 per second. Professor Petsko’s idea was to make crystallographic studies of such reactions in a refrigerated environment, where they would work more slowly.

When Professors Han Frauenfelder of the University of Illinois and Demetrius Tsernoglou of Wayne State University heard about this idea for low-temperature crystallography, they asked Professor Petsko to try it on a sample of myoglobin, a muscle protein. It worked, and now Professor Petsko and his colleagues think they have demonstrated “a powerful technique for looking at proteins as they are working.” □

The Extended Link Between Malnutrition and Subnormality

Consider a family of laboratory rats whose ancestors (for many generations) were so malnourished that they failed to perform normally on tests of learning and adaptive ability. The current generation, even if given a fully adequate diet, is similarly retarded in mental capacity. And at least the next two generations will also be subnormal, even if they, too, receive well balanced diets.

These findings, by Janina R. Galler, research associate in the Department of Nutrition and Food Science (she is also associate professor of psychiatry at Boston University), suggest that chronic malnutrition may have serious long-term implications not heretofore recognized.

“The implications of this research for human populations are clear,” says Dr.

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Galler. "By giving people with a history of poor nutrition adequate diets, we can achieve physical improvement. But these people, though they look normal, may learn more slowly and have more difficulties in social situations than they should simply because of the lingering effects of malnutrition.

"Poverty, nutrition, disease, and poor education interact with each other. These factors do not act in isolation," she says.

To study the next question, Dr. Galler will use a National Science Foundation grant for research on how an enriched living environment, combined with improved diet, may help overcome the lingering effects of malnutrition over several generations. □

Controlling the Carbohydrate Syndrome

The late-evening television-watcher who hankers after a carbohydrate-rich snack of pretzels or potato chips may be responding to a fundamental, natural urge: if he had a protein-rich dinner, his body is in fact ready for a carbohydrate-rich snack, whether he needs the calories or not.

Drs. Judith J. and Richard J. Wurtman, who are known for their research on the factors that control human appetite, now propose that separate neurochemical mechanisms regulate our appetite for proteins and for carbohydrates, that these mechanisms interact together to maintain a balanced — if not necessarily modest — intake of different types of foods, and that the same mechanisms may be used to help weight-watchers control their impulses to over-eat.

It seems to work this way, say the Wurtmans (they work in the M.I.T. Department of Nutrition and Food Science). A carbohydrate-rich meal causes the brain to make and release serotonin, one of the neurotransmitter chemicals that carry messages between brain cells. But the effect of an increase in serotonin is to reduce one's appetite for carbohydrates, thus presumably swinging the next meal in the direction of higher protein content. Then serotonin release falls, and the hunger for carbohydrates returns. There may in fact develop a kind of carbohydrate syndrome — a habitual, cyclic craving for carbohydrates following a protein-rich meal (usually at the end of the day).

A practical application of this new idea: use drugs that stimulate the release of serotonin to help dieters control their evening snacking impulses. □

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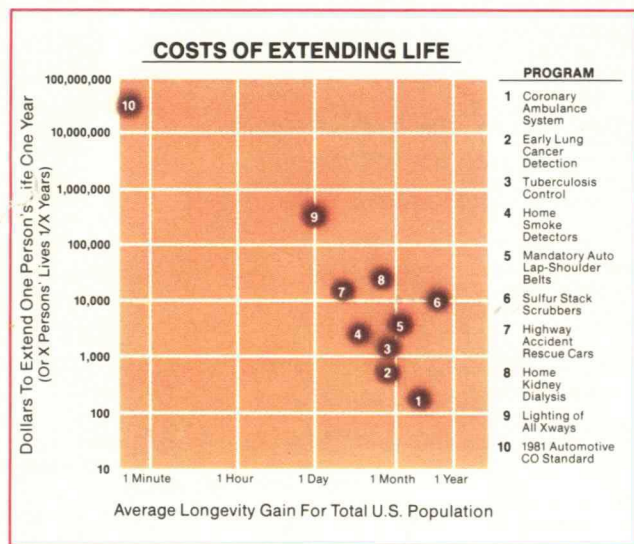
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